Appendix 19

Brookfield White Pine Hydro LLC, Responses to Comments on FERC DEA (July 2021) and MDEP's Draft WQC Order for Shawmut Project

a) BWPH Review of MDMR Model Revisions

Review of the Maine Department of Marine Resources (MDMR) Kennebec River Anadromous Fish Modeling Efforts and Fish Passage Needs for Atlantic Salmon, American Shad, Blueback Herring, Alewife, and Sea Lamprey

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I. Introduction

The following document provides Brookfield White Pine Hydro's detailed review and comments on MDMR's Kennebec River modeling efforts for Atlantic salmon and American shad. MDMR undertook these modeling efforts initially in late 2020 and into 2021 in support of a proposed rulemaking to amend the 1993 Kennebec River Management Plan (referred to here as the "2020 Plan Amendment"). Although the proposed amendment was eventually withdrawn, at the time, Brookfield White Pine Hydro LLC (BWPH), Licensee for the Shawmut Project (FERC No. 2322), filed extensive comments on the proposed amendment, including detailed comments and critique of the fish population models used by MDMR as the basis for their mistaken conclusions regarding fish passage effectiveness and the need for dam removal on the Kennebec River.

In recent comments filed by MDMR with FERC in response to the Shawmut Project DEA (letter dated August 16, 2021), MDMR continues to use the same flawed models to reach the same specious conclusions regarding fish passage needs on the Kennebec River. Although MDMR has made some changes to the models in response to BWPH's earlier comments, the following review demonstrates that models are still significantly flawed and have been developed and intentionally manipulated to support a predetermined outcome – that restoration of Atlantic salmon, American shad and blueback herring to the Kennebec River can be achieved, but only through the removal of the lower Kennebec River hydropower project dams.

The following is BWPH's review of MDMR's most recent Kennebec River modeling efforts for Atlantic salmon, American shad and blueback herring. It must be noted that at the time of this writing, BWPH became aware of other fish population modeling work, conducted on behalf of the USFWS, which may be being used by resource agencies in their continued review and consideration of fish passage needs and restoration outcomes for Atlantic salmon on the Kennebec River. Brookfield has not been provided an opportunity to review or comment on this modeling work, but would point out that any other modeling done by the agencies to draw conclusions regarding fish passage, anadromous fish restoration, and the future of hydropower projects on the Kennebec River should be subject to rigorous peer review, and made available for public review and comment as well.

II. Detailed Comments on Atlantic Salmon Modeling

MDMR's Kennebec River Factual Background document that was filed with FERC on August 16, 2021, describes fishway performance standards for Atlantic Salmon (Salmo salar). To generate these standards, MDMR stated that it "developed a deterministic model utilizing the best available data, current research, and knowledge of the watershed. The model was used to develop survival goals for upstream and downstream passage at each hydropower facility." Based on MDMR's modeling, the agency concluded that in order for Atlantic salmon to meet recovery goals required (USFWS and NMFS 2018), "smolt mortality needed to be 1% or less at each of the six dams and upstream efficiency needed to be 99% or better" to achieve restoration of the Merrymeeting SHRU population. Both standards are extraordinarily high and unprecedented. Neither standard has previously been required by agencies for Atlantic salmon management, nor have either been achieved in any salmon upstream/downstream dam passage field studies. Nor is there any evidence that these passage rates are achieved by salmon moving upstream and downstream in undammed rivers. Further, these are inconsistent with passage survival goals established by federal agencies responsible for Atlantic salmon restoration and management. As such, they lack a foundation for use as a performance standard at the Shawmut Project, as discussed herein.

To evaluate the basis for MDMR's conclusions regarding fish passage effectiveness needs on the Kennebec River, Brookfield has conducted its own detailed review of publicly available information regarding MDMR's model. This document describes the results of that review and reveals significant technical flaws as well as potential biases in many of the underlying model assumptions. Each of these errors build on each other to arrive at MDMR's conclusion regarding the need for such unrealistic fish passage effectiveness standards. Based on our review, Brookfield fundamentally disagrees that MDMR's Atlantic salmon model accurately depicts potential Atlantic salmon restoration outcomes for the Kennebec River. Thus, the model should not be relied upon.

BWPH's significant technical concerns about MDMR's model and the use of this model to support its conclusions include, but are not limited to, the following:

- The assumptions of forecasted Atlantic salmon production and survival for all life stages are not well supported or fail to reflect best available empirical data.
- The MDMR model is deterministic and as such, does not include or consider stochastic variability of model inputs. Without a stochastic structure, the model does not provide for a realistic range of potential outcomes within each of the modeled scenarios.

- According to MDMR's model output provided in Figure 2 of the Kennebec River Factual Background, only in scenarios that assume a very high smolt-to-adult marine survival rate (2.72%), do the projected annual wild adult salmon returns approach the delisting criteria in the Atlantic Salmon Recovery Plan (USFWS and NMFS 2018).
- The 2.72% marine survival rate assumed by MDMR exceeds the marine survival rates achieved during the last 50 years of Maine salmon restoration and recovery efforts. Using a contemporary marine survival rate, supported by more recent evidence and data, the model projections show that returns of Atlantic salmon will not approach the delisting criteria, even with 100% fish passage effectiveness.
- MDMR did not conduct a model sensitivity analysis to critical model inputs other than passage efficiency, MDMR's model demonstrates that low marine survival, rather than dam passage, is the limiting factor affecting the annual number of adult Atlantic salmon returning to the Gulf of Maine DPS.
- MDMR's continued insistence that salmon recovery requires extremely high downstream passage efficiency (essentially no losses) to compensate for low marine survival is disingenuous and sets an impossible standard for any dam owner on any salmon river. Indeed, even the eastern Maine salmon rivers of the Downeast SHRU (Dennys, Machias, etc.) which have NO dams, have not achieved salmon restoration in the last 50 years. This suggests either or both of two things; 1) even in the absence of dams there is not perfect (100%) upstream and downstream passage for Atlantic salmon, or 2) factors other than passage effectiveness are responsible for the failure to restore Atlantic salmon to these rivers.

The following sections provide specific comments on the MDMR Atlantic salmon model.

i. *Applicability of the Model*

MDMR inappropriately employed a simplistic desktop deterministic population model to predict Atlantic salmon restoration outcomes for the Kennebec River. MDMR then used model results to justify extremely high recommendations for passage standards at four mainstem Kennebec River dams. MDMR asserted that its model requires either dam removal or achieving their unprecedented passage efficiency to restore Atlantic salmon.

Deterministic population models do not account for annual/environmental variation, and therefore professional modelers caution that such models should be limited to assessing general trends, and to inform management decisions. In addition, deterministic models are not predictive because life history variation is averaged (Ford 1999; Barber 2018). MDMR's use of a deterministic model violates these basic rules. A stochastic model is necessary to predict the probability of salmon recovery.

MDMR's Kennebec River Atlantic salmon model is mathematically flawed. The model excludes important areas outside the Kennebec River, but within Merrymeeting Bay Atlantic salmon SHRU…areas that must be considered for downlisting or delisting the species. MDMR has failed to account for habitat in other watersheds such as the Sheepscot River that are within Merrymeeting Bay SHRU. More salmon there benefit the SHRU and by extension, the entire Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon.

The MDMR model is deterministic, unlike other established models that have been used to evaluate hydroelectric project fish passage jeopardy. NFMS, in its jeopardy analysis for Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon, uses a stochastic impact analysis model (Nieland and Sheehan 2020), rather than a deterministic population model and recently developed rigorously peer reviewed stochastic Atlantic salmon life history models in support of relicensing of projects such as Mattaceunk (FERC 2520) and Ellsworth (FERC 2727) and likewise will do so in its review of the Shawmut relicensing application.

Brookfield believes that MDMR's deterministic approach is the wrong type of model to evaluate specific upstream and downstream salmon passage effectiveness. Rather, a fully peer-reviewed stochastic model is needed to assess the extent to which the Merrymeeting Bay SHRU can reach Atlantic salmon recovery goals over a range of achievable fish passage scenarios and realistic marine survival.

ii. Model Assumptions

Major assumptions made by MDMR during development of their salmon model for the Kennebec River do not consider recent and available empirical mortality rate information for the freshwater and estuarine phases of outmigration. In addition, the MDMR model exaggerates the effect of upstream and downstream fish passage survival upon adult returns by arbitrarily compensating with inflated marine survival and assuming maximum smolt production across 100% of rearing habitat units in the Sandy River. The model also includes habitat in the Carrabassett River that is not ESA designated critical habitat. Indeed, Carrabassett River habitat is not even mentioned in the Salmon Recovery Plan (USFWS and NOAA 2018).

a. Freshwater Mortality is underestimated

MDMR's underestimate of natural (freshwater) river smolt mortality significantly inflates the number of smolts reaching the estuary in all MDMR model scenarios. MDMR utilized a natural riverine "freshwater" natural mortality rate of 0.0033/km adopted from Stevens et al. (2019). However, empirical estimates of the smolt freshwater mortality rate from the Penobscot River are roughly two to four times higher (range from 0.0069 – 0.0146/km with an average of 0.0104/km)

(Kleinschmidt Associates 2015; Normandeau Associates 2016-2018). Stevens et al. (2019) acknowledges that this freshwater mortality rate is likely an underestimate.

The MDMR also inflates in-river survival after passing the Kennebec River dams. Empirical estimates of smolt mortality in the reach immediately downstream of Lockwood were 0.0060 in 2014 and 0.0146 in 2015 (Normandeau 2018; Appendix D). Stich et al. (2015) estimated a smolt mortality of ~ 0.01/km: a significantly higher number than the rate used by MDMR in the model. MDMR's underestimate of natural (freshwater) river smolt mortality significantly inflates the number of smolts reaching the estuary in all MDMR scenarios, and demonstrates yet another weakness of their model.

b. Natural Smolt Mortality in the Estuary

MDMR used an inappropriate assumed rate of natural estuary smolt mortality in their Kennebec model. The MDMR model incorporated a deflated natural estuary smolt mortality of 12.8% (0.0034/km) developed originally for the Penobscot River, rather than a rate based on data from smolt migration studies in the Kennebec River.[1] Kennebec River smolts are exposed to Merrymeeting Bay, the largest estuary north of the Hudson River. This habitat is very different than estuary habitats of the Penobscot SHRU, where MDMR derived most of their Kennebec model estuary parameters. The Kennebec poses different mortality threats to salmon, including tidal flows unique to the Kennebec River and an abundance of predators (esp. abundant striped bass). Thus, data from estuary and lower river survival data from the Penobscot SHRU are not valid and should not be used as a surrogate.

MDMR ignored similar data that were recently collected from Kennebec River studies,[2] and chose Penobscot River data as a surrogate in the model. In the draft two-year summary report, NMFS opined that the results from the 2014 and 2015 smolt passage studies through the lower Kennebec River and estuary are consistent with similar studies conducted on other Maine rivers:

"We summarized survival (Table 1) [from Sidney to the outer estuary (beyond The Chops)] and array efficiencies calculated in MARK. To account for surgical effects and delayed mortality,

[1] As noted above, the 12.8% estuary mortality rate used by MDMR was based on Stevens et al. (2019). Stevens et al. (2019) incorporated the 12.8% natural estuary mortality rate based on a several of years NMFS unpublished studies of smolt passage in the Penobscot River estuary (J. Stevens, personal communication.

[2] NMFS, in collaboration with MDMR, conducted two years of smolt tagging studies in the lower Kennebec River using wild smolts from the Sandy River, tagged with transmitters and released downstream of Lockwood Dam (Goulette, et. al, 2017). Downstream movement was monitored to the outer Merrymeeting Bay using MDMR's array of acoustic receivers.

our assessment of survival starts at the Sidney site (river km 86.8). This may be revised in final models as we evaluate post-surgical dynamics. Our estimates of cumulative survival from the Sidney site to the outer Mill Cove array [still ~14 miles from the ocean] were higher for 2014 – 0.37 (95% CL 0.27-0.47) than 2015 – 0.32 (95% CL 0.23 - 0.42). Survival rates at each site, as measured by the PERT distribution are described in Table 1a and 1b. These estimates should be considered preliminary [emphasis added]. However, these reported survival rates are similar to those reported for naturally-reared smolts in the Narraguagus and Penobscot Rivers with hatchery smolt success seemingly a bit higher (Holbrook et al. 2011, Kocik et al. 2009)."

MDMR's inconsistently lower rate relied heavily upon Stich et al. (2015) Penobscot River smolt model assumptions. However, Stich et al. (2015) did not estimate a rate of natural mortality in the estuary under a "no dams passed" scenario. Kennebec-specific average smolt mortality through the estuary is approximately 48.6%, or a mortality rate of 0.011/km. This Kennebec mortality rate is much higher than the Penobscot rate of 12.8% which MDMR used in their deterministic model.

Any comparison of smolt migration through the lower river and estuary of the Kennebec River to Penobscot River, can only conclude that the river systems are markedly different—the lower rivers and estuaries have different hydrology, different fish communities, and different rates of smolt mortality—and there is no plausible explanation why Penobscot data would be used as a surrogate for smolt survival through the Kennebec, when several years of NMFS smolt mortality data for the Kennebec, including tidal and diel periodicity are available. This is another significant weakness of the MDMR model.

c. Whole River Smolt Survival

The MDMR model incorrectly calculates smolt survival through each of the specific river reaches resulting in a significant underestimate of whole river smolt survival to "The Chops"[3] in every scenario reported. Simplistically, given a starting population of 100 smolts migrating through 100 km long reach at a freshwater mortality rate of 1% per kilometer, MDMR's incorrect formula results in zero smolts alive at the end of the reach. The correct formula applies the per kilometer mortality rate to the number of smolts surviving to the beginning of each kilometer, and in this scenario results of 36.6 smolts[4] still alive at the end of the reach, versus MDMR's estimate

[3] The Chops is a narrows at the outlet of the Merrymeeting Bay estuary near Bath, ME.
[4] Km 1 = 100 smolts *0.01 = 99 smolts, Km 2 = 99 smolts *0.01 = 98.01 smolts, Km 3 = 98.01 smolts * 0.01 = 97.03 smolts, …, Km 100 = 36.97 smolts * 0.01 = 36.6 smolts.

of zero smolts alive. As a result, estimates of adult salmon returns in MDMR's model are significantly underestimated, and demonstrates yet another weakness of this model.

d. Delayed Mortality

MDMR's model, as well as Stich et al. (2015) and Stevens et al. (2019), assigns 6% additional delayed mortality in the estuary for each dam passed by smolts throughout all modeled scenarios, regardless of fish passage measures incorporated at dams and the Licensee's that would site specifically demonstrate meeting passage and timing standards. This estimate is not supported by telemetry studies conducted on the Kennebec River. Rather, it is an assumption based on selected Penobscot River studies (Stitch etal. 2015) with up to nine dams, various assumptions about smolt disposition, and certain pacific salmon studies. This is a significant flaw in MDMR's modeling work.

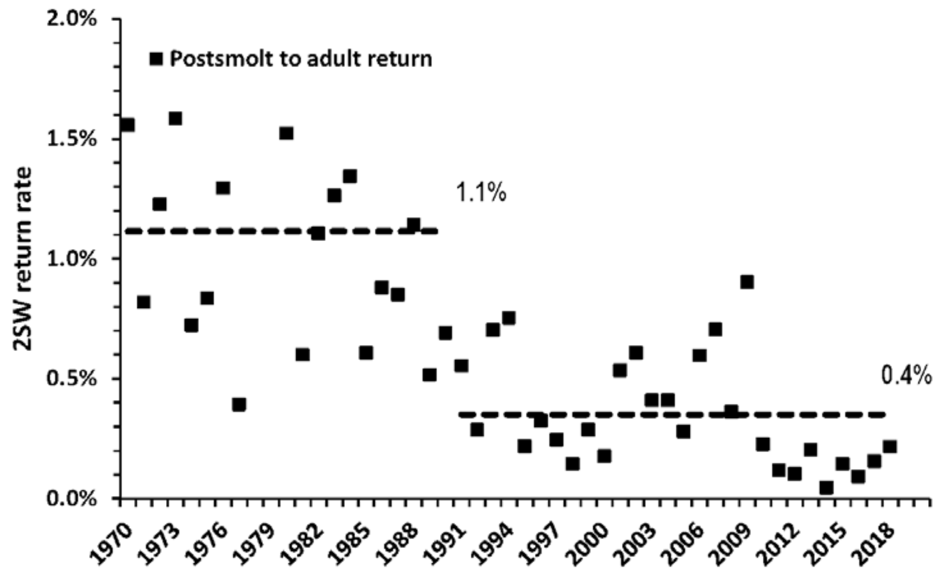
Assuming that 6% delayed mortality per dam will always continue is unsupported, subjective, and exaggerates dam-related smolt mortality in all modeled estimates. NMFS acknowledges that reduced migratory delay of outmigrating smolts at dams should reduce latent smolt mortality in the estuary (NMFS 2020 Mattaceunk BiOp)[5].

e. Marine Survival

As noted previously, the marine survival rate used by MDMR to inflate model outcomes in their salmon model is very high, unrealistically optimistic with little support and out of step with current survival rates going back decades. In pre-1980 studies, Baum (1983) examined Atlantic salmon marine survival rates based on Penobscot River tagging studies. Among all the years examined, the highest single year was a 2.29% return rate (see Table 15 of Baum, 1983). For all the years examined, Baum (1983) found "The annual survival to homewaters has averaged 0.53%." (see Baum 1983 at p.50). This is similar to NMFS' estimated marine survival as reported in the 2013 BiOp at 0.4% (NMFS, 2013).

[5] To further address this question, NMFS is collaborating with researchers from the University of Maine to analyze recent smolt survival in the Penobscot River estuary since completion of the Penobscot Restoration Project (2 dams removed and 1 bypassed) and implementation of downstream passage measures at the remaining dams pursuant the requirements of the lower Penobscot Atlantic Salmon Species Protection Plan and terms and conditions of the associated NMFS Biological Opinion and Incidental Take Statement (Jeff Murphy, NMFS personal communication). Once completed this study may provide further insight into the effects of dam passage (of any sort) on delayed estuarine mortality in salmon smolts. Until then, any estimate of the per dam effect on delayed mortality must be considered a guess, at best and should not be assumed to continue at the same rate year after year, despite continued improvements to downstream passage facilities.

In the USASAC (2021) report, NMFS estimates post-smolt marine survival (for 2SW returns) as 1.1% for the period 1970-1991, before what NOAA describes as the "marine survival regime shift," a marked decrease in the survival of 2SW salmon (see Figure below, from USASAC 2021, as based on Stevens et al. 2019). After 1991, NOAA estimates that marine survival shifted to a significantly lower regime with mean 2SW salmon survival rate of 0.4% for 1992-2021.[6]



Although the most credible estimates of marine survival for Atlantic salmon are less than 1%, unexplainably, MDMR used an arbitrary marine survival rate of 4% in it's original version of the model (as reported in the Kennebec Plan Amendment) and 2.72% in the latest version of the model (as reported in the Kennebec Factual Background document)[7]. It is important to note that only under this artificially high marine survival condition do any of MDMR's modeled scenarios project adult salmon returns approach delisting criteria, even under a "no dam" scenario.

In the most recent iteration (filed with the MDEP in July 2021) of MDMR's Kennebec River Atlantic salmon model, MDMR revised the low, average and high marine survival rates to the following, but MDMR provided no information, documentation or support for the new survival estimates other than to note that the rates were based on personal communication with John Kocik (NMFS)

Low = 0.321% (Penobscot River average 2008-2018, estuarine mortality removed, J. Kocik).

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[6] It is worth noting that the data may better described as a continuous decline over five decades of salmon restoration, rather than an abrupt "regime shift" in survival (Stevens et al. 2019).

[7] MDMR filed their Kennebec Factual Background document with their comments on the Shawmut DEA filed with FERC August 16, 2021.

Intermediate=1.08% (Penobscot River maximum 2008-2018, estuarine mortality removed, J. Kocik).
High = 2.72% (Penobscot River maximum 1969-2018, estuarine mortality removed, J. Kocik).

MDMR's assumptions regarding a reasonable range of marine survival rates for Atlantic salmon in their Kennebec model is inconsistent with NMFS' modeling approach for the Mattaceunk Project relicensing. For the NMFS dam impact assessment model of the Mattaceunk Project "*Quantifying the Effects of Dams on Atlantic Salmon in the Penobscot River Watershed, with a focus on Weldon Dam*" NMFS used a contemporary marine survival rate of 0.6% and then used three times that rate (1.8%) as a "high" rate of return.[8] NMFS' 0.6% marine survival rate used at Mattaceunk is significantly lower than the 2.72% rate used by MDMR on the Kennebec. Even NMFS' 1.8% "high" rate of return is significantly lower than the "high" marine survival rate used by MDMR in their Kennebec model (2.72%). MDMR provides no rationale for why they used a 2.72% marine survival rate rather than the rates used by NMFS scientists elsewhere in the GOM DPS.

Once again, Brookfield emphasizes that MDMR's modeled scenarios approach the delisting criteria for Atlantic salmon only by 1) using an extraordinarily high marine survival condition, and 2) underestimating freshwater and estuary survival.

The overestimate of the "high" marine survival significantly inflates the number of adult Atlantic salmon returns to the Kennebec River in all dam scenarios. In so doing, MDMR has manufactured a hypothetical condition under which the Merrymeeting Bay SHRU may reach the 2000 salmon recovery population size. No empirical estimates of marine survival support a conclusion that Atlantic salmon will achieve the abundance warranting delisting, not only in the Kennebec River, but in *any* of the GOM DPS Atlantic salmon SHRUs.

f. Smolt Production

All of MDMR's Kennebec River model scenarios overestimate smolt production from rearing habitats. This is an invalid assumption that should not be used in any reasonable model being used to project Atlantic salmon returns. The model assumes maximum level of smolt production from 100% of the units of rearing habitat upstream of Weston Dam. This high level of consistent smolt production would likely only occur under pristine habitat conditions (and a significant shift in

[8] NMFS provided no rationale or support for their use of the "high" marine survival rate (1.8%) used in their Mattaceunk Project analysis.

climate regime from current conditions). It is flawed because it ignores potential effects of climate change, water quality and pollution, sedimentation, non-hydro watershed connectivity issues and the presence of competing or predatory native and non-native fish species such as the pervasive smallmouth bass.

g. Spawning and Rearing Habitat

MDMR's model assumed that all adult Atlantic salmon returning to the Merrymeeting SHRU must pass all four mainstem dams to spawn, which serves to inflate passage mortality. In fact, Merrymeeting Bay SHRU Atlantic salmon have access to spawning and rearing habitat below a number of dams, all downstream of Weston Dam, as well as in the Sheepscot River basin which has no hydroelectric dams. Specific to the Kennebec River basin, the Atlantic salmon rearing habitat model developed by USFWS for the Kennebec watershed (Wright et al. 2008) during SPP consultation estimated that upwards of 30% of potential salmon rearing habitat in the drainage is downstream of Weston Dam. The model fails to account for salmon electing to spawn in these lower reaches that would experience fewer passage challenges.

MDMR has its own evidence of successful salmon spawning habitat below Weston. From 1975 to 1993, MDMR documented as many as 46 spawning salmon annually in Bond Brook and Togus Stream downstream of the former Edwards dam in Augusta (USASAC 1994). Their surveys also regularly documented the presence of various life stages of juvenile salmon. As a result, MDMR required a fishway in Bond Brook. Regarding Togus Stream, MDMR states that "Togus stream has the most and best Atlantic salmon habitat below mainstem dams on the Kennebec River…" and their recent salmon habitat improvements have improved fish passage and the flow of cold water in downstream reaches of Togus Stream (MDMR 2021).

MDMR's model arbitrarily ignores the availability of salmon spawning habitat in the lower river, and elsewhere in the SHRU and the potential benefits of natural reproduction of Atlantic salmon anywhere but in the headwaters of the watershed, above Weston. This puts a further inaccurate and undue burden on fish passage effects of dams on the Kennebec mainstem.

iii. Use of the Model to Draw *Conclusion Regarding ESA Listed Species*

MDMR argues that the very high fish passage effectiveness rates used in their salmon model are necessary to avoid "jeopardy" to the species[9]. MDMR is demonstrating that it is exceeding both its authority and technical expertise by misusing a simple life history model reach a jeopardy determination, and then requiring dam removal or an extreme upstream fish passage standard for salmon recovery. Furthermore, the agency may participate in federal Endangered Species recovery planning, but a jeopardy determination is certainly not within MDMR's regulatory authority.

iv. References

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[9] "jeopardy" is a specific term defined under the federal Endangered Species Act administered for Atlantic salmon in the state of Maine by NMFS. For listed species, the relevant federal agencies – in this case, NFMS – are responsible for analyzing the impacts of a proposed action, to determine the risk of jeopardy because of the action(s), and to determine whether an action(s) presents adverse modification of critical habitat.

U.S. Fish and Wildlife Service and NMFS. 2018. Recovery plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (Salmo salar). 74 pp.

Wright, J., Sweka, J., Abbott, A., & Trinko, T. 2008. GIS-Based Atlantic Salmon Habitat Model. Appendix C in: NMFS (National Marine Fisheries Service). Biological valuation of Atlantic salmon habitat within the Gulf of Maine Distinct Population Segment.

III. Detailed Comments on American Shad Modeling

Section 6.0 of the MDMR July 17, 2021 Kennebec River Factual Background document identifies the goal for American Shad as to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 1,018,000 wild adults to the mouth of the Kennebec River; a minimum annual return of 509,000 adults above Augusta; a minimum of 303,500 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 260,500 adults annually passing upstream at the Shawmut Project dam; and a minimum of 156,600 adults annually passing upstream at the Weston Project dam." In order to achieve a minimum annual returns for the species to the Kennebec River, upstream passage of adults would need to be at least 70% effective at each of the four dams and downstream passage of adults and juveniles at each of the four dams would need to be at least 95% effective."

Rationale for these performance standards is provided by MDMR in Section 3.6 of the recently withdrawn proposed 2020 amendment (2020 Amendment) to the 1993 Kennebec River Resource Management Plan which described a stochastic, life-history based, simulation model[10] developed by Dr. Daniel S. Stich (Stich 2020). This model is evidently similar in concept to a model previously developed for Penobscot River shad (Stich et al 2019). MDMR notes that "Dr. Stich ran 48 scenarios to explore the effects of downstream passage survival (1.00, 0.95, and 0.90) in combination with varying upstream passage efficiency (0.70-1.00) and time-to-pass (1, 3, 7, and 20 days per dams) on American shad distribution and abundance in the Kennebec River."

BWPH acknowledges the utility and usefulness of the Stich et al. (2019) model with regard to understanding the impacts of several passage scenarios on a simulated population of American shad. That said, MDMR has used results from this apparently unreviewed Kennebec River version of the model to recommend specific outcomes that range up to and include dam removal. Given the costly and far-ranging impact of these recommendations, BWPH would like to address questions regarding the appropriateness of the application of the Stich model by MDMR in

[10]Although MDMR lists the model as a reference to the 2020 Amendment, there is no indication that the model has been subjected to peer-review.

addition to questions regarding specific parameters assigned/utilized by MDMR during the model evaluation process.

i. Applicability of the Model

First, the model described in Stich et al. (2019) is undoubtedly very comprehensive and well parameterized. Despite this, the Stich model still has limitations in its applicability which are rooted in the inherent assumptions behind the model and the overall model type. The dam passage performance model for American shad presented in Stich *et al.* (2019) is an individual based model (IBM) with a one-dimensional movement analysis incorporated. The model focuses on the mean modeled population projections as indicators of the necessity of specific suites of passage performance criteria to achieve Plan targets. That approach is misapplied because it undermines the inherent stochasticity of the model and considers the result as deterministic. The model incorporates environmental stochasticity and inter-annual variability by drawing from parameterized distributions for many input variables. It is appropriate to use the model as a tool to assess the relative population trends, but not to consider the output as deterministic.

In a simplified sense, the model utilizes several pre-defined parameters of importance such as the starting total number of age-1 individuals in the population, marine survival, and temperatures of initial and terminal spawning dates, in addition to several derived parameters based on arrival date in the estuary and several biological characteristics such as growth and fecundity parameters which are interpolated from data obtained in the Connecticut River, not the Kennebec River.

ii. Evaluating Model Fitness

The greatest limitation of using an IBM-type model for projecting fish populations may be the inability to calibrate the model to observed data such as count data. This is a critical step in the review of a model prior to its use to make management decisions because it will reveal whether the model is capable of accurately representing the species in question.

Assessing a model's fit to an observed data set gives the model developer and managers an opportunity to evaluate their model performance in comparison with what is being observed in the river system in question. Some model types lend themselves to an analysis of retrospective 'peels,' which will indicate whether a model tends to over-predict, under-predict, or if the model can be considered accurate within an acceptable margin of error. This stepwise process allows for step-specific assessments of model fit and for adjustments to be made post-hoc to improve model performance, explanatory capability, and increase the accuracy or reliability of model outputs.

Unfortunately, this is not possible for an individual based model because it must run out the amount of time specified in the simulation and because it is based only on a few initial pieces of data, rather than continuously collected data. As a result, there is no quantifiable metric by which to decide whether the simulated adult returns predicted by the Stich model are representative of the observed data collected by MDMR and Brookfield biologists each year.

iii. General Model Assumptions

Within the selection of model type and parameter assignments, there are several assumptions, including:

- Inputs to the IBM are representative and reflective of that which is occurring in the natural system (i.e. Kennebec River);
- Outputs of the IBM are representative and reflective of that which is occurring in the natural system (i.e. Kennebec River);
- There are no significant differences in population structure, individual behavior, or biological parameters between shad in the Connecticut River and shad in the Kennebec River; and
- Fish make only one attempt at passage per day. And if the fish fails to pass, then it is assessed a time delay penalty of 24 hours. In reality, fish can and do make multiple attempts to pass upstream within a 24 hour period.
- Fish move upstream regardless of saturation of the downstream spawning habitat and the energetics of continued migration11.
- The model currently includes an unrealistic single, common downstream passage effectiveness/survival input value for both adult and juvenile shad. It should include separate effectiveness/survival input values for each life stage.

[11] Leggett, et al. (2004) demonstrates that this assumption has inhibited American shad recovery on the Connecticut River by enticing a pre-recovery sized population of shad to disperse well upstream rather than stay together in lower river reaches where they can spawn more effectively. This results in excessive expenditure of bioenergetics and migratory stress, with reduced adult survival, coupled to the risk of a percentage of spawners too dispersed to effectively fertilize eggs.

Any model is only as good as its key assumptions, and even a cursory review of the Kennebec River American shad model developed and used by MDMR raises considerable doubts about many of the assumptions used by MDMR.

a. Marine Survival

Additionally, following the assumption that the model input parameters and output results are representative of shad in the Kennebec River, it is explicitly stated by Stich (2019) that the shad passage model outputs are highly sensitive to changes in the parameter estimate for marine survival, which is based on an age-invariant rate of 0.62 (62%)for each annual period from young of year up until age-9 (maximum age in model) (ASMFC 2007).

Although a range of values were considered, Stich explicitly states "our ability to make more precise predictions would be improved by better information." This raises the question of the appropriateness of assuming not only a constant mortality across age classes, but also the validity of assuming that this rate of survival has remained unchanged over the past 14 years.

Lacking information, the Stich model incorporates a fixed rate of at-sea mortality within a given model run. Most fish species exhibit a type III survivorship pattern where mortality losses are generally associated with the earlier portion of life. Whereas assumption of a constant marine survival rate for older shad may be appropriate, the assumption of a single representative rate for first year fish with repeat spawners may not be appropriate.

Although the Stitch model accounts for simulated variability in this parameter, it is still informed by a single value which may be outdated and misrepresentative of the various age classes present in the population at any given moment.

b. Assumed Similarity of Connecticut River Population Data

Stich (2019) also states explicitly that "model outputs were sensitive to changes in growth of American shad in this study. This indicates that system-specific data would be preferable to using growth information from the Connecticut River population." This statement inherently casts doubt on the usefulness of the current Kennebec River model, as the incorporation of Connecticut River shad data may be likely to exhibit significant differences in key biological parameters that would have a large influence on model outputs. MDMR has provided no evidence that these differences were explored or considered, furthering the question of whether or not this model is appropriate to forecast Kennebec River shad populations.

c. Assumed Passage Attempts per Day

Furthermore, a critical assumption that is not explored in the Stitch et. al. (2019) publication is that fish make only one attempt at passage per day. This is evidenced in the upstream passage model description when Stitch et. al. (2019) states that “each fish was allowed one attempt per day to pass a dam.”

Despite the various parameters that were highlighted in the model’s sensitivity analysis as having a large influence over the output, this critical assumption is not tested and it does not appear that any variability in passage attempts has been, or can be, incorporated into the models constructed by MDMR.

This unquestioned assumption is a potential fatal flaw: diadromous species approaching a dam, as has been well documented, can make several attempts at passage per day. MDMR has not discussed or supported their upholding of this assumption with any literature or observational evidence to indicate how this assumption may impact model results or impact the various *time-to-pass* parameters explored by MDMR.

iv. Lack of Detailed Documentation

As noted above, it is worth addressing these questions regarding the appropriateness of MDMR’s use of this model as a means of making projections about shad populations to assess the proposed passage criteria in this amendment. In the 2020 Amendment MDMR stated the use of 48 scenarios under which three values of downstream passage survival were used with a combination of four values of delay and a range of passage efficiency values.

However, this model building process is not described in any detail that would indicate the results of each of these 48 scenarios, no tables were provided stating the assumed starting values needed to run these model scenarios, the number of iterations within each scenario is not described, and, most importantly, there is no discussion of which specific scenario(s) (and with what parameters) rendered the proposed passage criteria in this amendment.

v. *Lack of Peer Review Input*

As described by MDMR, the shad passage model used to inform the passage standards provided in Section 6.2 of the 2020 Amendment comes from the *'Shadia'* package in the statistical program R published by Dr. Stich. On the provided website and in the subsequent links it is stated: "These models are in various stages of completion *but are provided for transparency in their development and application* [emphasis added]."

Specific to the Kennebec River shad model, "This model has undergone preliminary review with fishery and habitat managers at Maine Department of Marine Resources and the National Oceanic and Atmospheric Administration Habitat Division." It is unclear from either the website or content provided by MDMR as to what the preliminary review has consisted of or whether or not the issues described above have been considered.

vi. *Conclusions*

While Stich et al. 2019 remains a useful tool to evaluate potential population impacts, MDMR relies on an unreviewed, and largely undocumented Kennebec River American shad model to develop recommendations that would have significant cost and social implications. A review of the model results as depicted in the 2020 Amendment raises significant questions regarding the applicability of the model, fundamental assumptions loaded into the model, and as such any conclusions MDMR has drawn from limited use of the model.

vii. *References*

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Leggett, W.C, T.F. Savoy, and C.A. Tomicheck. 2004. The Impact of Enhancement Initiatives on the Structure and Dynamics of the Connecticut River Population of American Shad. American Fisheries Society Monograph 9:xxx–xxx, 2004

Stich, D.S., T.F. Sheehan, and J.D. Zydlewski. 2019. A dam passage performance standard model for American shad. Canadian Journal of Fisheries and Aquatic Sciences 76: 762-779.

Stich, D, E. Gilligan and J. Sperhac (2020). shadia: American shad dam passage performance standard model for R. R package version 1.8.3. (https://github.com/danStich/shadia). Retrieved January 24, 2021.

Stich, D.D. Undated. Overview of the Kennebec River model (https://shadia-ui.github.io/about_kennebec.html). Retrieved January 24, 2021.

IV. Detailed Comments on Blueback Herring Modeling

Section 6.0 of the MDMR July 17, 2021 Kennebec River Factual Background document identifies the goal for blueback herring as "to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 6,000,000 wild adults to the mouth of the Kennebec River; a minimum annual return of 3,000,000 adults above Augusta; a minimum of 1,788,000 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 1,535,000 adults annually passing upstream at the Shawmut Project dam; and a minimum of 922,400 adults passing upstream at the Weston Project dam." In order to achieve the minimum annual returns for the species to the Kennebec River, upstream passage of adults would need to be at least 90% effective at each of the four dams and downstream passage of adults and juveniles at each of the four dams would need to be at least 95% effective."

Rationale for the upstream performance standard is provided by MDMR in Section 3.7 of the recently withdrawn proposed 2020 amendment (2020 Amendment) to the 1993 Kennebec River Resource Management Plan which described an unpublished stochastic, life-history based, simulation model developed by Dr. Daniel S. Stich (Stich unpublished). This model is evidently similar in concept to a model previously developed for Penobscot River shad (Stich et al. 2019) and which has been presumably modified to be representative for Kennebec River blueback herring. MDMR did not include any reference to a proposed downstream passage standard for adult or juvenile blueback herring as part of their recently withdrawn 2020 amendment.

Many of BWPH's comments and concerns regarding the Kennebec River blueback herring model echo our comments and concerns regarding the similar Kennebec River American shad model (Section III, above). BWPH acknowledges the utility and usefulness of the original Stich et al. (2019) model with regard to understanding the impacts of several passage scenarios on a simulated population of American shad.

That said, MDMR has used results from this unpublished and unreviewed model to recommend specific outcomes that range up to and include dam removal. Given the costly and far-ranging impact of these recommendations, BWPH questions the applicability of using this model to develop blueback herring passage standards without adequate peer review. Brookfield is also concerned about the near-total lack of documentation of model inputs or assumptions used in developing the model runs.

i. <u>Applicability of the Model</u>

According to the description provided by the author (Stich, unpublished) the current Kennebec River blueback herring model incorporates some species-specific data from the Hudson River and assumes the majority of movement data for the species are the same as that for American shad.

While BWPH understands the adoption of surrogate data for this less studied species, it does raise questions with regards to the predictive abilities of the model and the legitimacy and accuracy of the associated performance standards that are being put forth by MDMR for blueback herring specific to the Kennebec River.

Although the model described in Stich et al. (2019) is comprehensive and well parameterized, it was originally built and described exclusively for shad passage. This limitation was specifically recognized by Stich et al. (2019) wherein the author's state state "Differences between species in addition to site-specific considerations further complicate this problem and preclude a one-size-fits-all solution of fish passage."

ii. <u>General Model Assumptions</u>

Further on Stich et al. (2019) notes that the model can be readily extended to other species given alterations to input data, such as biological parameters, path information, etc. However, MDMR has failed to present these parameters, how they are different from the shad model, and what evidence supports the use of these parameters and their assumed values.

Similar to details provided by MDMR in the 2020 Amendment for American shad, model details in the plan for blueback herring are limited to a single line describing a set of model scenarios. No supporting documentation associated with model inputs or the 48 outputs used to develop the proposed fish passage effectiveness standard for blueback herring are provided.

iii. <u>Conclusions</u>

Assuming MDMR relied solely on this model output and given the lack of species and watershed specific input data, Brookfield feels the development of the blueback herring passage standard provided in the Kennebec River Management Plan is premature.

Similar to that previously described for American shad, the Stich model has limitations in its applicability which are rooted in the inherent assumptions behind the model and the overall model type. These potential impacts are previously described for the American shad model in Section III and are consistent with the concerns associated with the blueback herring model.

iv. References

Stich, D.S., T.F. Sheehan, and J.D. Zydlewski. 2019. A dam passage performance standard model for American shad. Canadian Journal of Fisheries and Aquatic Sciences 76: 762-779.

Stich, D.D. Undated. Overview of the Kennebec River model (https://shadia-ui.github.io/about_kennebec.html). Retrieved January 24, 2021.

Stich, D.S. Unpublished. Kennebec Blueback Herring model.

V. Detailed Comments on Alewife Habitat and Production Estimates

Section 3.8 of the MDMR's2020 Amendment to the 1993 Kennebec River Resource Management Plan (1993 Plan) lays out a series of measures to support restoration of alewife (*Alosa pseudoharengus*). MDMR claims that "In order to achieve a minimum number of spawners (608,200 adult alewife) to historic habitat in the Kennebec River, upstream passage of adults would need to be at least 90% effective at each of the four dams and downstream passage of adults and juveniles at each of the four dams would need to be at least 95% effective." MDMR explains that these passage standards were developed through alewife habitat and production estimate modeling.

Brookfield agrees that effective passage in both directions is vital to restore and maintain self-sustaining populations of migratory fish. However, a review of MDMR's explanation of how its new effectiveness standards were derived raises serious questions about MDMR's methodologies, documentation, and conclusions. MDMR appears to have inappropriately used a deterministic model, failed to adequately document and disclose its core assumptions, and then failed to discuss any reasonable alternatives to achieving its management goals.

i. *Applicability of the Model*

A deterministic population model produces results that are entirely driven by the parameters that are programed into its calculations. Changing key assumptions in the inputs directly changes the output. While useful for many purposes, deterministic population models have several well-known and well-documented limitations.

For the 2020 Amendment, MDMR inappropriately adapted an existing, deterministic alewife population model to develop and propose the passage standards for the four mainstem Kennebec River dams. MDMR claims these standards are critical for restoring an annual alewife run of 608,200 adult spawners upstream of Lockwood Dam. The basic structure and inputs of the original model have been described in Barber et al. (2018); the same information and the R code is annotated at the model web site[12].

[12] The model is available at https://umainezlab.shinyapps.io/alewifepopmodel/

In attempting to use this model on the Kennebec River, MDMR failed to heed the warnings and instructions explicitly stated by the model developers: that users of this model should "not make detailed predictions about the exact number of alewife that will return in a given time frame." (Barber et al. 2018).

Barber et al. (2018), explains that deterministic models such as this one address general trends in a population and can help inform management decisions by testing sensitivities within life histories, but because variation in the spawning run is averaged, these models are not predictive.

As a result, this model is intended for the sole purpose of comparing different management strategies and understanding their general impacts, but is **unable to forecast accurate, well-informed projections** of alewife abundance or population size. Barber et al. stresses that key assumptions of the model which can greatly impact model output must be kept in mind when interpreting the results of the model. Among these key assumptions are the following:

- Environmental parameters are constant within *and* between years;
- Inputs values (life history, behavioral, and biological characteristics) are representative of that which is occurring in the natural system (i.e. the Kennebec River); and
- Quality of spawning habitat in the Kennebec River does not vary spatially.

It is well known and well documented in literature that annual runs of river herring species are heavily influenced by highly variable environmental parameters such as water temperature and flow conditions. These parameters exhibit substantial temporal variance within years and inter-annually such as high/low snowfall years causing high/low spring flow conditions in addition to acute changes in flow or temperature caused by storm events or abrupt climactic changes.

This type of environmental variability can delay, hasten, or temporarily impede river herring runs. Understanding that the timing of river herring runs can be late or early and subject to multiple peaks is a key driver of why models which make the assumption of environmental constants are unable to produce accurate and reliable projections of abundance or population size. Failure to account for environmental variance both within and between years introduces a tremendous amount of uncertainty into model outputs.

ii. General Model Assumptions

As discussed above and as explicitly identified by model developers, the use of population-averaged input values is strongly discouraged in population modeling due to the uncertainty introduced by the failure to account for population variance, outlying values, etc.

Uncertainty has been introduced to these model outputs through the use of fixed environmental constants, population averaged input values, and through assumptions disregarding spatial variability (i.e. that St Croix alewife populations are biologically and behaviorally similar to Kennebec River populations in addition to assuming all habitat is of equal production quality).

MDMR has failed to provide any written or circumstantial evidence to justify these assumptions when making management decisions regarding alewife in the Kennebec River system. These are all assumptions which form the cornerstone of the model developers' warnings as to why this model is not intended and, more importantly, unable to make accurate, well-informed projections of abundance or population size. Brookfield acknowledges the importance of this model as a tool for *comparing* management scenarios to understand general impacts and resulting trends but questions its appropriation as a population projection and management decision tool by MDMR.

iii. Failure to Document Modeling Efforts

Ignoring the inappropriateness of this model to project alewife population estimates and the violated assumptions discussed, MDMR proceeded to use the model to develop upstream and downstream passage standards without providing the information necessary to support those specific requirements.

As can be seen in Figure 3 from the 2020 Amendment, MDMR's model lacks measurements of uncertainty around the estimate lines. It displays no confidence limits, no error bars, etc. on the forecasts generated from the population model to allow readers to see where the estimated populations sit relative to the Maine and ASMFC escapement goals. Lines presented in Figure 3 from the 2020 Amendment provide only the mean estimates of alewife spawner abundances for a series of upstream and downstream passage effectiveness rates relative to fixed values of mean Maine and minimum ASMFC escapement goals for the species. Failure to provide a measurement of error around those abundance estimates prevents the reader from understanding the magnitude of variation around those values.

Without referencing any form of uncertainty around the estimates, it is not possible to understand the margin of error behind these outputs, consequently bringing to question the reliability of the estimate. Presenting a single line with no variance is misleading and makes it look as though targets are either always achieved or never achieved, which is not realistic.

iv. Failure to Consider Alternatives

It would be naïve to assume the proposed passage standards are the only viable way to achieve a return of adult alewives upstream of Lockwood Dam in excess of 600,000 fish, particularly given the success of adults returns observed in the adjacent Sebasticook River. Since 2006, alewife passage in the Sebasticook has regularly numbered 2-5 million individuals. At present, alewife returns to the Sebasticook must navigate the fish lift facility at Benton Falls (only designed to pass 600,000 alewives annually), the Burnham fish lift (design details not provided by MDMR in the 2020 Amendment) and the fish ladder at Sebasticook Lake. In addition to those obstructions there are several other fishways located at lake dam outlets within the drainage.

To BWHP's knowledge, these unexpectedly abundant returns to the Sebasticook River have occurred in the absence of comprehensive/rigorous passage efficiency studies at the three sites, application of passage standards at the three sites (such as the unrealistically demanding standards being required in the MDMR 2020 Amendment for the 4 mainstem dams owned by Brookfield subsidiary companies), and despite the seemingly under-designed fish lift at Benton Falls Dam.

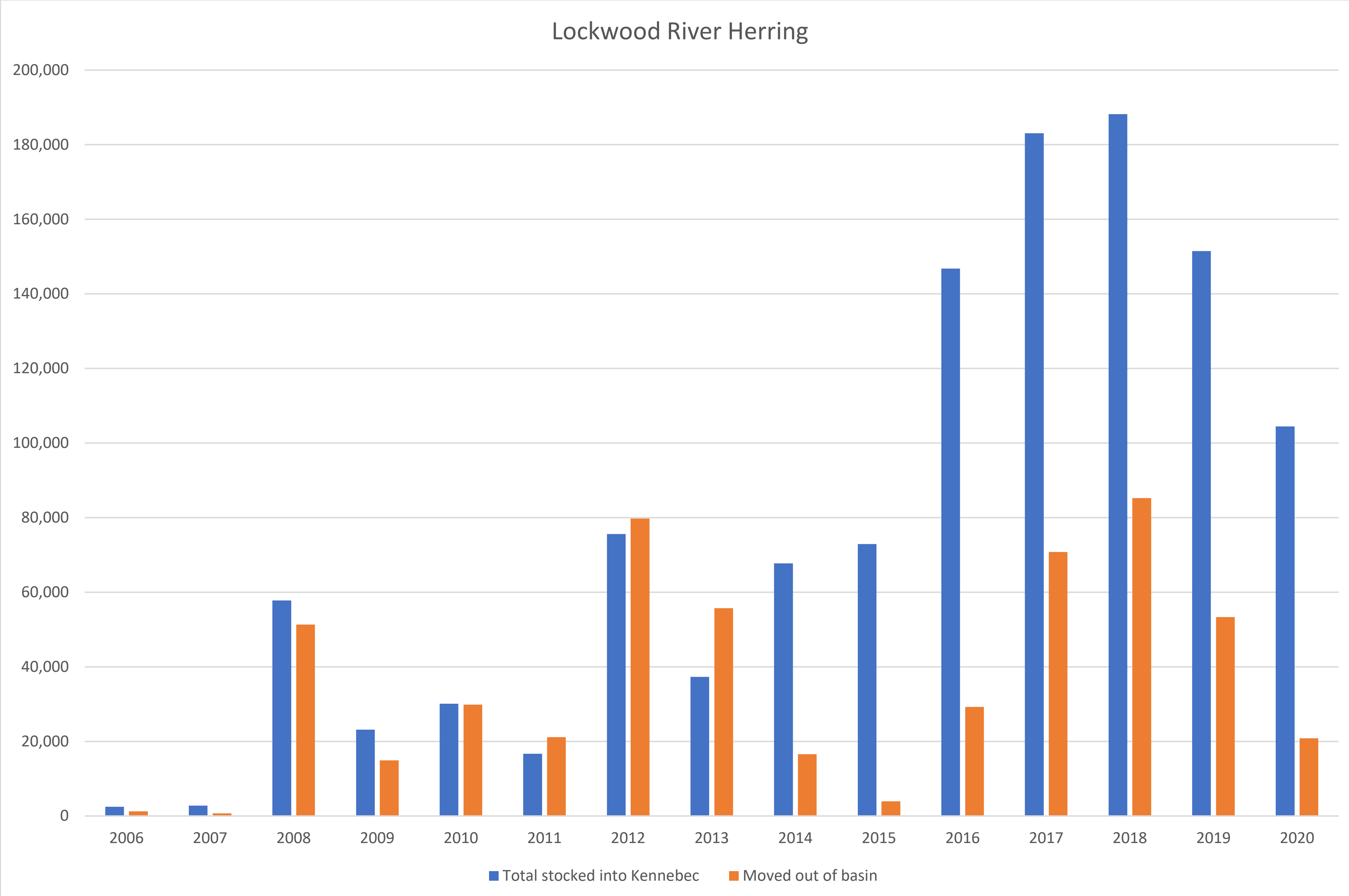
v. Existing Passage and Stocking Conditions in the Kennebec River Basin

MDMR undertakes the trucking of migratory species from the Lockwood lift, including the trucking of river herring both within and outside of the Kennebec River basin. As shown in the table and figure below, an approximate average of 30% of the river herring captured at the Lockwood lift from 2009 to 2020 annually were trucked to other rivers and ponds outside of the Kennebec River basin. The MDMR's goals for river herring restoration on the Kennebec are perplexing given MDMR's current management practices of relocating river herring out of the Kennebec.

vi. References

Barber, B. L., A. J. Gibson, A. J. O'Malley, and J. Zydlewski. 2018. Does what goes up also come down? Using a recruitment model to balance alewife nutrient import and export. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 10: 236-154.

Year	Captured at Lockwood	Trucked to Sebasticook Drainage	Trucked to Wesserunsett Lake	Trucked to Shawmut Headpond	Trucked to Hydro Kennebec Headpond	Percentage of Wesserunsett Stocking Rate Limit (6 fish/acre)	Percentage of Wesserunsett Capacity Stocked (235 fish/acre)	Total stocked into Kennebec	Total stocked into the basin (Kennebec & Sebasticook)	Moved out of basin	Percentage stocked out of basin
2006	4,094	359	2,503	0	0	29%	0.74%	2,503	2,862	1,232	30%
2007	3,448	0	2,762	0	0	32%	0.81%	2,762	2,762	686	20%
2008	131,201	22,074	9,855	47,944	0	114%	2.90%	57,799	79,873	51,328	39%
2009	45,969	7,870	10,207	12,947	0	118%	3.00%	23,154	31,024	14,945	33%
2010	76,745	16,807	10,045	9,000	11,040	116%	2.96%	30,085	46,892	29,853	39%
2011	37,847		4,618	8,078	4,000	53%	1.36%	16,696	16,696	21,151	56%
2012	179,358	24,000	12,962	51,380	11,250	149%	3.81%	75,592	99,592	79,766	44%
2013	103,242	10,213	16,340	16,475	4,500	188%	4.81%	37,315	47,528	55,714	54%
2014	115,667	31,361	14,622	35,865	17,250	169%	4.30%	67,737	99,098	16,569	14%
2015	91,850	15,000	15,320	42,300	15,301	177%	4.51%	72,921	87,921	3,929	4%
2016	224,990	48,950	17,251	73,200	56,352	199%	5.08%	146,803	195,753	29,237	13%
2017	289,188	35,350	13,372	74,250	95,444	154%	3.94%	183,066	218,416	70,772	24%
2018	307,035	33,585	9,436	80,698	98,049	109%	2.78%	188,183	221,768	85,267	28%
2019	240,594	35,750	11,183	58,105	82,193	129%	3.29%	151,481	187,231	53,363	22%
2020	143,259	18,000	14,929	22,115	67,390	172%	4.39%	104,434	122,434	20,825	15%


Lockwood River Herring
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Total stocked into Kennebec
Moved out of basin

VI. Detailed Comments on Sea Lamprey Habitats and Kennebec River Populations

The 1993 Kennebec River Resource Management Plan (1993 Plan) was developed by the Maine State Planning Office pursuant to 12 MRSA § 407 following substantial public comment and legislative review. The Maine Department of Marine Resources' (MDMR) proposed 2020 amendment (2020 Amendment) to the 1993 Plan included a new goal of restoring sea lamprey (*Petromyzon marinus*) to "historic spawning and nursery habitat."

While restoring sea lamprey on the Kennebec River may indeed prove be a worthwhile goal, as discussed below this represents a direct reversal of the 1993 Plan, a change significant enough to warrant consultation with other relevant agencies and public comment and consideration. The 2020 Amendment did not provide a substantial argument for the public good that would be achieved by this reversal. While sea lamprey are an ecologically important species they are also not considered under threat in Maine. Further, the 2020 Amendment completely fails to establish the necessity for dam removal in order to protect this species.

i. *Background*

Sea lamprey are widely distributed in marine and freshwater habitats of the North Atlantic. They typically reside in freshwater as ammocetes (the larval stage) for up to 6-8 years (Almeida and Quintella 2014, NatureServe 2013). The range of sea lamprey in the northwest Atlantic extends from Labrador to Florida, including landlocked populations in Lake Champlain and the Great Lakes. Sea lamprey in the northeast Atlantic are a separate population that are found in Norway, Iceland, and the Barents Sea south to northern Africa, including the western Mediterranean Sea.

Sea lamprey are categorized as a species of least concern by the International Union for Conservation of Nature in view of the large extent of occurrence, large number of subpopulations, large population size, relatively stable population, and lack of major threats (NatureServe 2013).

The U.S. Fish and Wildlife Service (USFWS) has never received a petition under the Endangered Species Act regarding sea lamprey.[13]

Sea lamprey gained access to inland waters of North America via canals and locks and became established as freshwater populations. Specifically, the Champlain Canal connected the south end of Lake Champlain to the Hudson River in 1823, while the Erie and Welland canals gave sea lamprey access to Lake Erie in 1825 and subsequently to the entire Great Lakes watershed. Sea lamprey decimated lake trout (*Salvelinus namaycush*) and other recreational and commercial species in these large lakes (Lennox et al 2020, Dodge et al. 1993).

Early efforts to control lamprey in the Great Lakes failed, but lampricides, lamprey attractants, and lamprey barriers have been used with some success for decades to reduce lamprey abundance and eliminate ammocetes (juvenile lamprey) from selected tributaries of the Great Lakes (Lennox et al. 2020, McLaughlin et al. 2006), and Lake Champlain (Nashett et al. 1999).

Sea lamprey is an anadromous species that is an exception to the normal anadromous life history pattern of homing to a natal river (Lennox et al. 2020, Waldman et al. 2008). Lamprey also differ from other anadromous fishes in that its adult phase is parasitic, a feeding strategy that makes homing problematic for mature lamprey since they are likely to become widely dispersed in marine habitats through transport while attached to the diverse hosts they parasitize. Genetic testing of lamprey collected in 11 rivers from the Delaware River to the Gulf of St. Lawrence found no significant differences in gene frequencies, demonstrating regional panmixia of sea lamprey in the northwest Atlantic (Waldman et al. 2008).

Thus, lamprey originating from individual rivers contribute nothing unique to the population. Rather, each river contributes to the abundance of the regional sea lamprey population in accordance with the number of juvenile sea lamprey that successfully leave the river, survive in the ocean, return to a river/stream, and spawn. Where they spawn, the size and locations of rivers and streams is also irrelevant; only the proximity of suitable spawning and nursery habitats is important. That is, the adults need spawning habitat (gravel/pebble substrates) and emergent larvae must find nursery habitat (silt/sand backwaters) immediately downstream, but spawning and survival of any population are not dependent on access to particular rivers or lakes.

[13]USFWS Environmental Conservation Online System (ECOS), accessed 12Oct2021.

ii. *Sea Lampreys in Maine and Current Management*

In Maine, sea lamprey are commonly caught in the spring in fishways in the major rivers, although they are not regularly counted, or reported in fish passage reports. Sea lamprey are known to move upstream via fish lifts, vertical slot fishways, various traps, and some Ice Harbor fishways. However, fishways that do not provide suitable surfaces (i.e., irregular or porous) for the mouth to adhere do not pass lamprey effectively. The USFWS reports that the Holyoke fish lift on the Connecticut River has passed an average of 32,507 sea lamprey annually since records began in 1975.

As noted above, the 2020 Amendment proposed a new goal of sea lamprey restoration. This was not a minor policy adjustment, but instead a significant change from the 1993 Plan. Not only was lamprey restoration *not* a goal of the 1993 Plan, the 1993 Plan specifically exempts lamprey from the migratory fish passage goals: "With respect to the Kennebec River, it is the State's goal to restore all anadromous fish *except for lamprey eels* [emphasis added] to their historical range." The 1993 Plan categorized sea lamprey along with common carp as "pest species" that should not be allowed to move any further upstream than possible and specifically, not beyond the Lockwood and Fort Halifax dams (1993 Plan, Appendix G).

iii. *Conclusions*

In the 2020 Amendment, MDMR repeatedly stated that sea lamprey can no longer access "native" or "historic" spawning habitat in the Kennebec River. But these assertions were entirely unsupported. Lacking any studies of lamprey passage in Maine, the 2020 Amendment simply states that fishways do not work and dam removal is needed to restore a "Kennebec" sea lamprey population.

However, the sea lamprey population is not dependent on reproduction in the Kennebec watershed, nor spawning in any single river, or any given year. Regional panmixia of sea lamprey in the northwest Atlantic Ocean means that spawning anywhere supports the population. Indeed, no legal protection has ever been requested for this species and no management has ever been implemented in Maine. The species is widely distributed and stable not only in Maine, but throughout the range (Maitland et al. 2015, NatureServe 2013).

The changes between the 1993 and the 2020 Amendment with regards to sea lamprey management seemed irreconcilable and so great as to be far beyond the scope of a simple plan amendment. Quietly editing an old plan to completely reverse a management objective was not appropriate under the circumstances, particularly if the public opinion of Maine residents might be opposed to the presence of a non-threatened parasitic species in waters where prized game fish are present. Instead, a new plan – subject to due public comment and legislative review – should be developed to reflect new management priorities.

iv. References

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b) Shawmut NLF Review Technical Memos

TECHNICAL MEMORANDUM

To: Randy Dorman, Brookfield

From: Kleinschmidt

Date: September 15, 2021

Re: **Review of MDMR's Comments and NLF Conceptual Designs Filed with FERC for the Shawmut Project (P-2322)**

EXECUTIVE SUMMARY

- In comments filed with FERC on August 16, 2021 the Maine Department of Marine Resources (MDMR) asserts that an approximately 1,260-foot-long continuous rock ramp nature-like fishway (NLF) at the Shawmut Project (Project), using a conceptual design developed for MDMR by Inter-Fluve, is feasible and is recommended for implementation in conjunction with the existing agency-approved design for a fish lift at the Project.
- A 2019 feasibility assessment (2019 Feasibility Study) of fish passage alternatives was conducted by Kleinschmidt on behalf of Brookfield, in consultation with agencies, including MDMR. One of the alternatives evaluated for feasibility was the concept of an NLF at Shawmut in the same general area as the 2021 MDMR conceptual design, on the western shore adjacent to the powerhouses. However, the 2019 Feasibility Study concluded that insufficient space was available to build an NLF given the expected width and length of the structure necessary to comply with USFWS design criteria and given surrounding property and infrastructure limitations. Therefore, this alternative was eliminated from further consideration in the 2019 assessment.
- The NLF conceptual design put forth by MDRM includes two potential layouts but does not effectively advance the potential for an NLF in this location. Many of the same impediments that eliminated the alternative from further consideration in the 2019 Feasibility Study have been identified in the 2021 MDMR conceptual design, but with no supporting research or information to assess how these design issues could be resolved, if even possible.
- It is our understanding that the NLF conceptual design put forth by MDMR was not developed in consultation with or previously reviewed by Brookfield or the other fishery resource agencies, some of which may have competing resource interests and management goals, and different goals for fishway performance criteria.

- The MDMR's NLF conceptual design is based, in part, on the NLF at the Howland dam.[1] However, the two sites differ in significant ways (hydraulic head, overall dam length, and flow control type). Further, the Howland NLF has never been quantitatively evaluated for upstream passage effectiveness, thus its effectiveness is unproven.
- The NLF conceptual design put forth by MDMR relies upon three key assumptions that are largely speculative and unsupported:
    - Adding an NLF at Shawmut will more effectively meet agency fish passage goals than the proposed, agency-approved, fish lift;
    - Property and infrastructure issues at the Shawmut Project site are not limiting; and
    - The proposed NLF concept would meet current federal agency design criteria and be acceptable to the other fishery resource agencies.
- The conceptual design presented by MDMR lacks sufficient supporting details regarding geotechnical conditions, potential environmental contamination, hydraulic analysis, land ownership, local zoning setback requirements, existing or potential rights-of-way, access, recreational use, and other issues that may affect feasibility.
- In summary, Kleinschmidt has substantial concerns regarding the technical feasibility of an NLF at this location for the following reasons:
    - The MDMR conceptual design puts the fishway entrance at the most downstream point of the Project tailwater, which is not the most effective location for successful fish passage and is not a location substantially supported by the siting study conducted at the Project during agency consultation on fish lift design;
    - The MDMR conceptual design does not include resting pools which is contrary to current federal fishery resource agency design criteria. The lack of resting pools and the high estimated average velocities[2] that result along the entire 1,260-foot-long fishway are not consistent with the USFWS criteria (USFWS 2019), or recommendations, and guidelines put forth by the federal fishery resource agencies (Turek, et. al. 2016). By not including resting pools, the excessive velocities may result in an impassible fishway for the target species.

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[1] *The Howland bypass NLF is located at the Howland dam on the Piscataquis River (Penobscot River basin), in Maine.*

[2] Potentially e*xceeding 6 feet per second (fps) at the low end of the operating range and potentially exceeding 9 fps at the high end of the operating range; depending on channel roughness.*

- The hydraulic inlet control structure proposed in the MDMR conceptual design is unprecedented for an NLF with irregularly shaped channel and varying bed elevation; would be inordinately complicated to design, construct, and operate; could result in debris accumulation at the fishway exit; and could be a barrier to fish passage.
- Without establishing the basic viability of the NLF designs, there is no basis to recommend an NLF as a viable alternative to be included with the fish passage design already proposed by Brookfield and approved by the agencies.

BACKGROUND

The Shawmut Project is located on the lower Kennebec River, where the Project dam is the third dam on the river, upstream of the Lockwood and Hydro-Kennebec projects. Since the early 1980s the lower Kennebec River has been the focus of restoration efforts for anadromous fish including Atlantic salmon, American shad, and river herring (alewife and blueback herring). In support of these efforts Brookfield proposed the installation of a new upstream fish passage facility at the Shawmut Project as part of the 2013 Interim Species Protection Plan (ISPP) that was developed in consultation with state and federal fishery resource agencies and approved by FERC in 2016.

Brookfield conducted a preliminary evaluation of fish passage alternatives at Shawmut as part of the 2019 Feasibility Study. This evaluation, conducted in consultation with MDMR and other stakeholders, considered the potential feasibility of an NLF and concluded that an NLF was not feasible at Shawmut, primarily due to limited physical space and potential conflicts with existing infrastructure.

In December 2019, in accordance with the provisions of the ISPP and the conditions of the Shawmut Project FERC license, Brookfield filed final design plans for a fish lift to be installed at the Shawmut Project. The fish lift designs were developed in consultation with the fishery resource agencies, and at that time the fish lift was proposed to be constructed in 2021 and operational in 2022.

In January 2020, Brookfield submitted an application to relicense the Shawmut Project with FERC. The current FERC license for the Project expires in 2022. As part of that license application, Brookfield proposed to continue to operate the new proposed fish lift (which presumably would be operational by the time the new license was issued), to make additional improvements to the Shawmut downstream fish passage facilities, and to monitor and test both upstream and downstream fish passage facilities, to ensure that the facilities were providing effective fish passage for the target species, relative to certain performance standards.

In July 2020, FERC noticed that the license application was ready for review and requested agency preliminary terms and conditions. In August 2020, NMFS, USFWS, MDIFW and MDMR all filed comments in response to FERC's notice, along with Section 10(a), 10(j), and Section 18 recommendations and preliminary prescriptions. The Section 18 preliminary prescriptions filed by NMFS included prescriptions for the construction and operation of an upstream fish lift at Shawmut. MDMR's 10(a) recommendation was that the Shawmut Project be decommissioned and removed. No agency suggested or recommended a nature-like fishway (NLF) for the Shawmut Project.

In July 2021 FERC issued a draft Environmental Assessment (DEA) for the Project. In August 2021 MDMR filed comments on the DEA. As part of their comments, MDMR included a conceptual design for an NLF at the Shawmut Project developed by Inter-Fluve. This was the first time that any agency had recommended an NLF for Shawmut, and the design had not been reviewed by Brookfield, or agencies other than MDMR.

The following memo provides an initial review of the conceptual NLF designs for Shawmut filed with FERC by MDMR. As further background, the memo also reviews the 2019 Feasibility Study, and revisits assumptions and conclusions that were drawn regarding the feasibility of an NLF at Shawmut at that time.

This initial review is intended as a preliminary assessment of the conceptual designs including feasibility and potential effectiveness. The recently filed concepts lack additional investigation of site constraints identified by the 2019 Feasibility Study, nor are current USFWS design criteria addressed. Without significantly more detailed analysis, the feasibility of constructing an NLF and the likelihood it would meet agency fish passage effectiveness goals is unsubstantiated.

KENNEBEC FEASIBILITY STUDY (2019) FINDINGS

In 2018 and 2019, Kleinschmidt evaluated options for enhanced fish passage options at three of Brookfield's hydroelectric projects on the lower Kennebec River with the goal of maintaining renewable energy production (Kleinschmidt 2019). The study focused on the projects within the Brookfield White Pine Hydro portfolio, which includes Lockwood, Shawmut, and Weston. The objectives of the study were to explore a range of fish passage improvements at each site; to evaluate the benefits to the aquatic resources; and to explore a range of energy enhancements that could be pursued to offset lost generation as a result of fish passage improvements. The 2019 Feasibility Study was undertaken as a screening level analysis and Kleinschmidt did not prepare conceptual drawings for any fish passage concepts considered or develop hydraulic models of the concepts; however, the concepts were evaluated based on Kleinschmidt's decades worth of experience in fish passage in this region, and based on readily available site information, and a general layout/footprint developed for each alternative.

Four major categories for improving fish passage were evaluated for each site, including Shawmut. These included full dam removal, decommissioning in place with installation of an NLF similar to that of Howland, installation of an NLF while maintaining the generating facility, and installation of the currently planned, agency-approved, fish lift at Shawmut. For the option that maintained generation, two possible alignments for an NLF were considered.

The first NLF alignment considered at Shawmut was an excavated channel south of the existing canal and 1982 powerhouse, similar to the concept put forward by MDMR. This option was dismissed at the time due to the estimated width required to excavate the channel and install the required side slopes in accordance with USFWS design criteria known at the time.

Scaled aerial photographs of the Shawmut Project site demonstrated that that the available space between an adjacent private residence and the existing Central Maine Power (CMP) substation was approximately 230 feet. The review concluded that this would provide an inadequate buffer between the existing structures and property boundaries to construct the NLF channel at an assumed maximum width of at least 200 ft, and acknowledged that the hydraulic head at this site may require deeper excavations that could yet increase the overall fishway width. Being located in the Town of Fairfield's Industrial land use category, minimum front, side, and rear setback requirements of 25 feet is unachievable, assuming the entire NLF would be categorized as a "regulated area" (Town of Fairfield 1999). In contrast, the MDMR NLF designs filed with FERC includes two alternatives, one with a similar footprint and one with a narrower footprint which resulted in a narrower overall channel of approximately 170 feet.

The 2019 evaluation also identified a concern about the proximity to the existing railroad and the potential for the NLF to project into the railroad's right of way. The MDMR NLF concepts assume that this may not be a concern, but this conclusion requires confirmation with the railroad and town regarding right-of-way and set back restrictions, which is missing from the MDMR conceptual design effort.

During the development of the 2019 Feasibility Study the Chinet Groundwood (formerly Keyes Fibre) mill building adjacent to the Shawmut Project was still standing and was not yet decommissioned. Thus, the conceptual NLF considered in 2019 was assumed to be routed around the mill building. Since then, the mill buildings have been removed and the land turned over to the Maine Department of Inland Fisheries and Wildlife (MDIFW) to provide public access and a hand carry boat launch. Because both of the MDMR NLF conceptual designs would traverse the site of the former mill, unknown soils, contaminants, geotechnical concerns, and the potential for buried utilities and conduits exists which are acknowledged but not otherwise addressed by MDMR.

BROOKFIELD CONCEPTUAL DESIGN EFFORTS

As part of agency consultation efforts for the 2019 Feasibility Study, studies conducted to evaluate several fish passage alternatives were vetted with state and federal agency and non-governmental organization (NGO) representatives. At the time no participants expressed a need or interest in further pursuit of an NLF.

In addition, Kleinschmidt understands that the design efforts for the currently proposed fish lift took place over the course of several years with the fishery resource agencies, including MDMR. It is our understanding that Brookfield's current proposal to construct a fish lift at Shawmut is primarily based on a siting study that used both CFD modeling and empirical study data that demonstrated a clear location where upstream migrants congregate. The entrance location for the MDMR NLF conceptual design is *not* a location where fish congregated. This fact raises significant concern about the ability for upstream migrants to find the NLF entrance as it is shown in the MDMR conceptual designs.

MDMR NLF CONCEPTUAL DESIGNS (2021)

The following sections provide the review of the NLF conceptual designs proposed by MDMR, as filed with FERC on August 13, 2021.

NLF CONCEPTUAL OPTIONS

MDMR's conceptual designs are based on the Howland bypass NLF, citing "*indications of effectiveness*" of the Howland bypass and are cited as a path to improve fish passage performance in addition to Brookfield's proposed fish lift at Shawmut. The MDMR NLF concepts were not compared to the currently proposed fish lift, and provides no discussion or analysis to demonstrate that an NLF would address any perceived limitation of Brookfield's proposed fish lift design or would improve fish passage performance in any way. The MDMR NLF conceptual design materials provide no data, discussion, or analysis to demonstrate that an NLF would enable achievement of MDMR's performance standard goals for target species at the site. Furthermore, the MDMR NLF design materials do not consider the effects of adding an NLF at the Shawmut Project along with the agency-approved fish lift on fish lift operations or effectiveness, nor does it consider the fish lift's effects on NLF operation and effectiveness. There is no reason to conclude that adding an NLF, as suggested by MDMR, would improve the expected effectiveness of upstream fish passage for the four target species at Shawmut over what would be provided by the proposed, agency-approved, fish lift.

The Howland NLF provides an example of an operational NLF in Maine, designed to pass the same anadromous species of interest in the lower Kennebec. However, there are significant and important differences between the Howland site and Shawmut that must be considered:

- Howland dam is the site of a decommissioned hydroelectric project rather than an active generating facility, so comparisons between the two are limited, particularly in terms of flow management.
- The hydraulic head at Howland dam is only 17.2′ at low flow vs. 24′ at Shawmut and the Shawmut Dam is twice as long as the Howland Dam.
- There is no need for an actively-managed hydraulic control structure at Howland because all river flow passes through the NLF during most of the fish passage season.
- The Howland NLF is untested and its effectiveness has not been established so there is no factual basis to conclude that the effectiveness of the Howland NLF meets the performance standard sought by DMR, or that similar success could be anticipated at Shawmut. [3]

The two primary alternatives developed in the MDMR design concepts at Shawmut consist of an excavated channel extending from the existing canoe put-in, located approximately 250 feet downstream of the 1982 powerhouse, upstream along the south shore to the headpond at the canoe portage take-out, with the primary difference between the two alternatives being the width of the channel. Both alternatives are routed along a narrow

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[3] In 2015, as a prerequisite for building the Howland NLF, the Penobscot Restoration Trust agreed to develop an effectiveness monitoring plan (Plan) in consultation with federal and state fishery agencies, Including Maine DMR. The Lower Penobscot River Basin Comprehensive Settlement Accord (Accord) requires that the Penobscot Trust demonstrate that the Bypass provides "*safe, timely and effective fish passage*" for targeted diadromous fish species. The Accord further specifies monitoring of the effectiveness of the Proposed Bypass, in consultation with the Resource Agencies and Penobscot Indian Nation (PIN), and make minor adjustments, as necessary, for a period of 15 years from installation of the fish passage facility at Milford." The Penobscot Trust also must comply with the terms and conditions of the December 23, 2009 Biological Opinion (as amended November 29, 2012) (BO). Term and condition No. 6 requires the Penobscot Trust to monitor the effectiveness of the Howland fish bypass in passing Atlantic salmon upstream and downstream for three years. Specific study methods for Atlantic salmon upstream effectiveness were identified but the Plan recognized that studies could not commence until sufficient adult salmon of Piscataquis River origin could be obtained. The plan calls for a telemetry study that would target returning Piscataquis-native adult fish passing through the Milford fishway for tag insertion. In order to identify these individuals, the telemetry study phase will need to be preceded by programmatically marking sufficient numbers of Piscataquis-native juvenile salmon. The telemetry phase will await the subsequent return of sufficient numbers of these marked fish to Milford as adults. To date this has not occurred.

corridor that is bound by a private residence, railroad, and a substation owned by CMP. Of the two conceptual designs put forward by MDMR, the maximized width NLF uses a wetted width of approximately 100 feet while the reduced width NLF uses a wetted width of 80 feet.

The MDMR conceptual design considered two alternative entrance locations for the NLF, though both alternatives have issues that preclude them from serious additional consideration. One alternative would require the demolition of the 1982 powerhouse by shifting the entrance further upstream, locating it just downstream of the 1912 powerhouse. This alternative would eliminate nearly half (4 MW) of the Project's 8.65 MW total generating capacity—and as such, is not a reasonable alternative to provide fish passage and retain existing generating capability.

The other alternative would shift the entrance downstream approximately 250 feet, resulting in a longer and less steep fishway. However, any improvements in efficiency resulting from the shallower slope would likely be offset by the entrance being located further downstream from the competing attraction flows lessening the ease of detection by fish and thereby adding to migration delay[4].

DESIGN REVIEW

As noted above the two NLF bypass alternatives are similar in concept and loosely based on the design of the Howland bypass NLF. Key concerns with the MDMR conceptual designs are:

- The designs do not appear to meet existing USFWS criteria (USFWS 2019) for NLFs in terms of dimensions, specifications, and hydraulics. The Howland NLF was designed prior to the release of either the 2016 Interagency Guidelines (Turek, et. al. 2016) or 2019 USFWS design criteria (USFWS 2019); both documents are frequently cited by fishery resource agencies, including MDMR, when proposing passage requirements. Using the Howland NLF as the basis for an NLF at Shawmut may result in a concept that fails to conform to current fishway design guidance.
- A flow control structure at the NLF hydraulic inlet would be needed to properly operate the NLF across a wide range of flow and Project operational conditions. Such a structure would be inordinately complicated, unprecedented for an NLF with irregularly shaped channel and varying bed elevation, and could result in a velocity barrier to the target species.

[4] This entrance location would be away from competing station flow and therefore could undermine attainment of agency performance criteria.

- The designs raise significant concerns with abutting properties, access and infrastructure, including the CMP substation and powerlines, as wells as the dam structures themselves, that were not addressed.
- The designs were developed using publicly available LiDAR rather than survey grade terrain data and lack any detailed subsurface data such as the depth and type of soil, the depth of bedrock, and rock quality.
- The designs do not address the potential presence of contaminated soils, the location of any underground structures or utilities, or the potential need to relocate existing utilities.

Also as noted above, the two sites are not appropriate for comparison due to Howland being a decommissioned generating facility while Shawmut is not. Head and flow conditions are significantly different between the two sites, which will drive design slopes, length and width of the channel, and flow management between the hydro facility and the fishway. From a conceptual design perspective, the limitations and unknowns surrounding site conditions and footprint of an NLF are the same as identified by Kleinschmidt in 2019 during the Feasibility Study. Pursuit of an NLF design as presented in MDMR's proposal requires significantly more detailed investigation to sufficiently evaluate viability of an NLF at Shawmut.

NLF Dimensions

Both MDMR NLF alternatives consist of a broadly sweeping meander bend that extends around the south side of the dam, and are longer and steeper than the Howland bypass. When measured along the low-flow portion, the maximum width channel is approximately 1,273 feet long, with an average hydraulic gradient of approximately 2 percent; while the reduced width channel is approximately 1,266 feet long, with a similar gradient. Although this is within the published acceptable slopes for an NLF for these target species (Turek et. al., 2016), by contrast, the Howland NLF is only 1,050 feet long with an average gradient of 1.5 percent.

The Howland bypass has a low-flow hydraulic head differential of up to 17 feet, whereas the stated hydraulic head at Shawmut across its operating range is 24 feet. The MDMR conceptual NLF at Shawmut has a 40 percent increase in hydraulic head, but only an approximately 20 percent increase in length compared to the Howland site. This is likely due to the fact that the concept developed for Shawmut does not include any resting pools, which is contrary to standard NLF design practice (Turek, et. al. 2019) and USFWS design criteria (USFWS 2019) and will further decrease passage effectiveness.

The Howland NLF had a design minimum flow depth of 1.5 feet; the NLF depth criteria has since been set at a minimum recommended flow depth of 2.25 feet for Atlantic salmon and American shad (Turek, et. al. 2016). Thus, reliance upon the Howland NLF design for an NLF design at Shawmut in 2021 may not be appropriate for complying with the current design criteria put forth by the federal fishery resource agencies.

The stated lengths for the conceptual NLF designs put forward by MDMR appear to include a portion of the sloping surface of at the downstream end of the NLF that would be backwatered under low-flow tailwater conditions, thereby effectively shortening the length of the proposed fishway. As stated in the Inter-Fluve memo prepared for MDMR, the proposed NLF was already "*spread along the maximum channel length available within constraints*"; thus, a longer fishway may not be feasible at this site.

However, as presented the conceptual NLF length is shorter than what Kleinschmidt believes will be required by the agencies due to its lack of resting pools and backwatered portion at the downstream end, which is not consistent with USFWS (USFWS 2019) and resource agency design criteria (Turek, et. al., 2016) and which would compromise the effectiveness of the NLF. The addition of resting pools in conformance with USFWS criteria (USFWS 2019) would significantly increase the length of the NLF design that would require the design to either incorporate a revised alignment connecting to an entrance located even further downstream, or implement berms on either side of the downstream end of the existing alignment to extend the fishway further downstream.

Both options would further isolate the NLF entrance and attraction flow from the generating flow and would likely reduce effectiveness. An alternative to increase the radius of the fishway curve to generate the necessary additional length is not feasible as this would encroach on the private landowner and not meet local ordinance requirements for setbacks from abutting properties (e.g., private landowner and CMP transmission facilities and corridor).

Both NLF alternatives put forward by MDMR include a multi-stage cross section, with a 20-foot wide (flat bottom width) low-flow channel that sweeps to the outside of the bend, and a mildly sloping high flow overbank area that extends to the inside of the bend. The deeper low-flow portion of the channel (4-4.8' deep) helps to concentrate lower flow conditions while the overflow bank provides a zone of passage as flows increase and velocities in the low-flow channel increase. The high flow overbank is approximately 70' wide for the maximum width alternative and 50 feet wide for the reduced with alternative with depths ranging from approximately 0-3 feet.

Unlike the Howland NLF, the MDMR NLF concepts for Shawmut do not include a pool and riffle profile along the low-flow channel. The low-flow channel proposed by MDMR for a Shawmut NLF appears to be designed as a continuous riffle with no pools. These pools provide critical resting areas for fish as they ascend the channel and are standard practice in fishway design and are part of the USFWS design criteria for NLFs. The Howland bypass NLF, for example, includes 75 foot long, zero gradient resting pools every 120 to 150 feet along the length of the low-flow channel, whereas, the designs developed for the Shawmut Project do not even though the higher head, would necessitate a longer and/or more steeply sloped fishway, making resting pools more critical for the NLF to meet performance standards.

NLF Flow Control And Velocities

One of the most critical elements of any successful fish passage design, and one of the most significant unknowns about the MDMR NLF design is the hydraulic inlet control structure that would regulate flows in the NLF. The proposed concept for an NLF at Shawmut is intended to be operational for river flows of 2,540 cubic feet per second (cfs) to 20,270 cfs, while the powerhouse generation capacity is 6,700 cfs. Without a hydraulic inlet control the proposed fishway (reduced width option) is reported to pass 1,500-2,000 cfs across the proposed operational range of river flows. Based on fish passage design guidance, (USFWS, 2019), agencies usually require that fishways at hydroelectric projects have a minimum attraction flow of 5 percent of powerhouse capacity. At Shawmut, that equates to a low design flow of 340 cfs.

In addition, Kleinschmidt preliminary review indicates that velocities may exceed target species' sustained swimming speeds and guidance criteria for maximum weir notch velocity criteria for two of the four target species at the low flow conditions in the NLF. The conceptual designs lack detailed evaluation of fishway hydraulics, a necessity in order to determine the feasibility of this design to effectively provide fish passage for the four target species. Specifically, there is no evidence that MDMR used resource agency guidance regarding the applicability of the weir notch velocity criteria in Turek et. al. (2016), along with consideration of lower sustained swimming speeds being more applicable to a 1,200-foot long continuous riffle.

Flow Control

Although the MDMR NLF conceptual design materials note that a hydraulic inlet control structure may be required to limit flow into the fishway during low river flows, a review of the feasibility of a hydraulic inlet control structure that could regulate flow into the NLF while maintaining effective fish passage was omitted from the conceptual designs. Kleinschmidt believes that such a structure *is necessary* in order to accommodate the range of flows from 340 cfs to 2,000 cfs within the channel, as the NLF would need to be capable of passing this full range of flows all while the headpond remains constant at the normal pond level of 112 feet. As noted below, based on the proposed geometry of the channel, if only 340 cfs were discharged into the channel, the flow depth would likely be in the range of 3.15 to 3.8 feet. Since the proposed upstream invert of the channel is set 5 feet below the normal pond elevation, this means that there would be a hydraulic drop of 1.2 to 1.85 feet across the proposed hydraulic inlet control structure.

A single gate with a hydraulic drop of 1.2 to 1.85 feet would be a barrier to fish passage; therefore, a set of two or three weir gates would have to be arranged in series to spread this hydraulic drop into multiple smaller increments that are passable for fish. To Kleinschmidt's knowledge, such a design has never been implemented in an NLF with an irregular channel geometry due to the complexity of the hydraulics that such a structure would introduce to the fishway. Designing a set of gates that can control flow across the full width of an irregularly shaped channel with a varying bed elevation would be a complex challenge in and of itself. An additional challenge is that the gate(s) in-line with the low-flow channel would need to have one or two additional gates sistered in series downstream to reduce the hydraulic drop to a level that is passable for fish. This would be an unprecedented hydraulic feature for an NLF.

Design of an effective hydraulic inlet control structure would need to be very carefully evaluated to ensure that it does not create unfavorable hydraulics (e.g., high velocities, excess turbulence) in the low-flow channel and that it does not create a passage barrier when its gates are in the lowered position. The need for mid-channel abutments between the gates would also have to be evaluated, as this could become a debris trap or adversely impact flow and fish passage.

VELOCITY

If a reasonable hydraulic inlet control can be established to limit flow in the fishway to 340 cfs, the flow depth would likely be in the range of 3.15 and 3.8 feet and the average velocity would likely be in the range of 4.6 fps to 6.8 fps, depending on the channel roughness[5]. This higher velocity exceeds the resource agency recommended maximum weir notch velocity of 6 fps for river herring (Turek, et. al. 2016). Further, the 6 fps notch velocity criteria assumes the fish are capable of a quick burst to get through that short area of higher flow at a weir, not a 1,200-foot long riffle sequence flowing at that velocity.

[5] Based on preliminary calculations for the reduced width fishway with the stated hydraulic gradient of 2 percent and Manning's "n" values of 0.045 up to 0.080.

At the higher flows in the proposed MDMR NLF concept at Shawmut, average velocities in the fishway are anticipated to range from approximately 5.2 fps up to 9.2 fps[6]. The upper limit of this range exceeds the recommended maximum weir notch velocity for three of the four target species (Turek, et. al. 2016), let alone swimming 1,200 feet at these velocities. The MDMR design fails to provide a basic evaluation of these velocities and their location (and corresponding depth) to determine suitability for fish passage in this NLF.

SITE CONSIDERATIONS

As acknowledged in the MDMR NLF conceptual design materials, the conceptual NLF layout is already "spread along the maximum channel length available within constraints." Kleinschmidt agrees without reservation that the conceptual designs are located in a constrained space that presents a series of potential limitations that have significant implications to feasibility, particularly if a longer fishway is required due the proposed concept's lack of resting pools and backwatered portion at the downstream end.

For example, the NLF concepts filed by MDMR are routed along the south side of the dam, through a narrow corridor that is bounded by private property, a railroad, and a substation. Both alternatives show the proposed fishway abutting the property line of the private residence located adjacent to the existing railroad. Further, as the proposed 2:1 slope will require armoring with stone and, depending on the design details, this stone may need to extend several feet along the horizontal (existing) surface) towards (or potentially crossing) the property line. As previously noted, assuming an NLF associated with a FERC-licensed project is considered a regulated area, local zoning setback requirements cannot be met, and would require Code Enforcement to consider a variance.

Further, the MDMR NLF concept design documentation lacks assessment of any easements that likely must be secured in order to construct an NLF. Obtaining such easements can potentially add considerable delay, cost, and uncertainty to construction. The maximum width NLF is noted to project onto CMP's property and utility corridor. The area needed for construction of the bypass channel on the CMP property is estimated to be approximately 1,000 square feet. However, additional real estate may be required to maintain access to the property owned by MDIFW and Brookfield that would be located south of the NLF and isolated from the rest of the property.

While the reduced width NLF eliminates the portion of the NLF that would be constructed within CMP's utility corridor, an easement may still be required to allow access to the

[6] Based on preliminary calculations for the reduced width fishway with the stated hydraulic gradient of 2 percent, depths in the low flow channel of 5 feet, and Manning's "n" values of 0.045 up to 0.080.

isolated property owned by MDIFW and Brookfield and local setback requirement would still not be met. In addition to the potential easement needed from CMP they also have several (9 for the maximum width NLF and 6 for the reduce width NLF) high voltage utility poles within the footprint of the proposed fishways. As acknowledged in the concept design materials filed by MDMR with FERC, feasibility of relocating these poles was omitted. A similar analysis is required for any other utilities that may be in the area including the existing hydrant that would need to be relocated or any subsurface utilities (e.g., sewer and water) that have not been identified to date.

The MDMR NLF concept design information includes a minimum setback of 16 feet from the substation to the edge of grading but lacks any assessment of whether the stability of the substation would be affected by the required excavation or assessment of whether the breaching of the upstream earthen berm for the fishway installation would increase potential for flooding of the substation. The supporting information filed with the concepts also lacks any analysis of potential adverse effects on the grounding grid for the substation by the required excavation.

The MDMR NLF concept design information neglects to consider dam safety concerns associated with the designs. Both NLF concepts will extend through the existing earthen dike and cut off wall that extends across the upland area west of the dam for about 250 feet. This structure currently provides flood protection for the low-lying areas located downstream of this structure, which includes the existing substation. With the construction of the proposed NLF, the section of ground between the bypass channel and the river upstream of the existing earthen dike will become part of the water retaining structure of the dam. As a result, this proposed embankment will need to be evaluated and designed to meet FERC dam safety requirements and provide the same level of flood protection as the existing structures. Such an evaluation was not considered or included in the design information filed with FERC. Based on the existing ground elevations upstream of the earthen dike the proposed embankment may need to be raised. Additionally, a new cutoff wall that extends from the existing cutoff wall to the upstream end of the NLF and that is tied into the proposed hydraulic control structure may be required to prevent seepage through the embankment, but the design concepts appear to have neglected consideration of potentially critical dam safety issues.

Both NLF concepts will run through the site of the former China Groundwood (previously Keyes Fibre) mill (Figure 1). Concept design information acknowledged the potential presence of unknown material and indicated potential contaminated soil issues. However, no assessment of the impacts of the presence of legacy structures or historic contamination has been conducted. According to Brookfield operations personnel familiar with the mill demolition, remnant infrastructure (e.g., sewer and drainage) remains buried at the site. None of these factors nor how they could be addressed are analyzed in the MDMR NLF conceptual design materials. Encountering such issues can add considerable delay, cost, and uncertainty to construction. A thorough assessment of potential legacy contamination at an historic industrial site is critical to evaluating the feasibility of the MDMR NLF designs.

Also noted in MDMR's filing with FERC but omitted from concept design information is a detailed evaluation of how NLF layouts will interfere with access to the dam. This will require construction of a new access bridge spanning the bypass channel suitable for heavy equipment. A new bridge would likely consist of, at a minimum, a two-span steel girder bridge to accommodate necessary equipment. The access bridge at Shawmut will need to be wider and larger than that constructed at the Howland NLF to accommodate heavier loads required for maintenance and emergency access of the dam and powerhouse, as well as mobile substation equipment by CMP for the adjacent substation. Assessment of a new access bridge is a significant component necessary to fully consider the viability and cost of constructing the NLF concept.

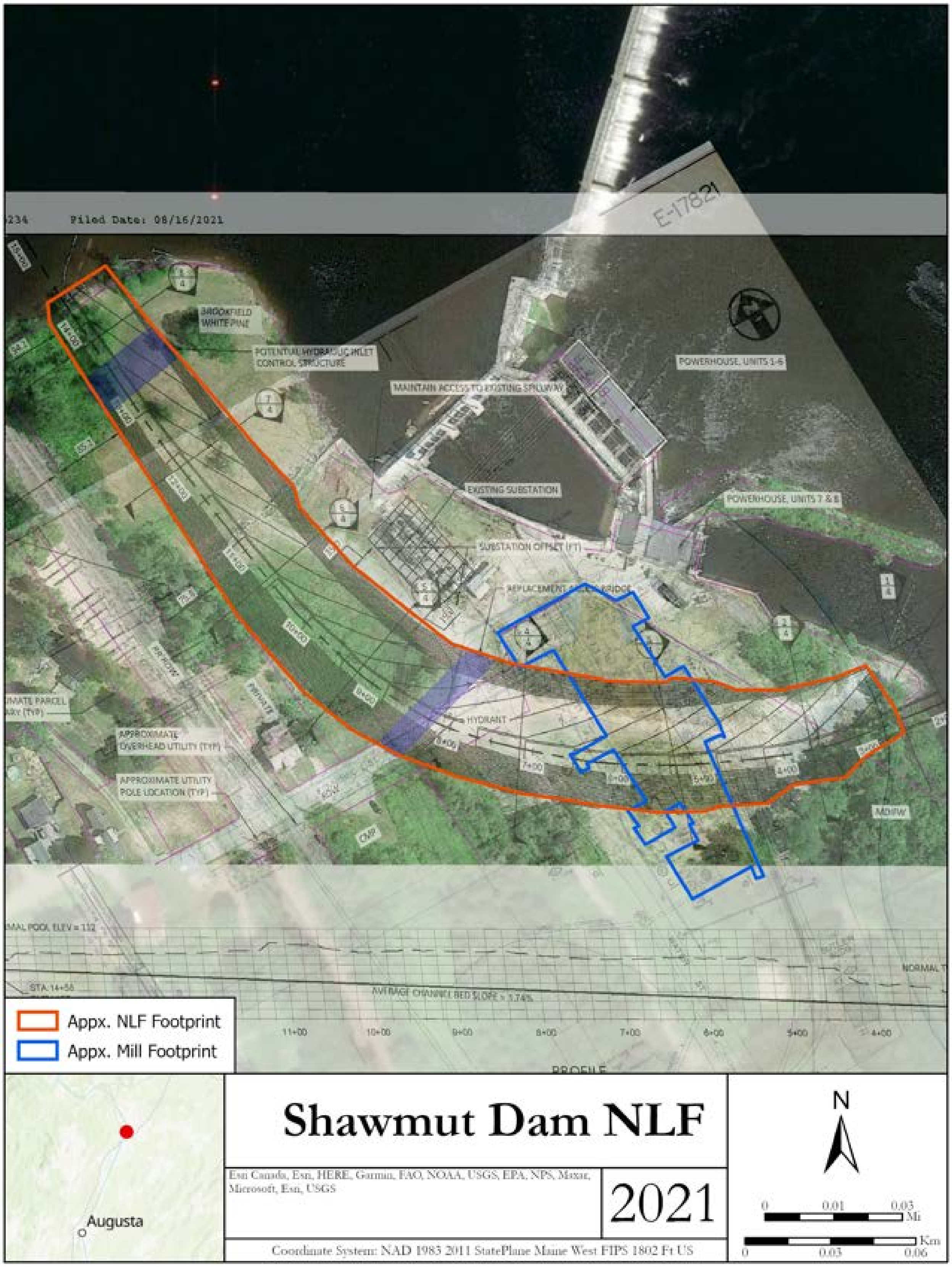

Figure 1. NLF Map.

Fish Passage Considerations

Per agency recommendations, it is Kleinschmidt's understanding that Brookfield's proposed fish lift for Shawmut is designed to accommodate 1,535,000 blueback herring, 134,000 alewives, 177,000 American shad, and 12,000 Atlantic salmon.

The NLF concept designs lack resting pools. But based on the USFWS design criteria (USFWS, 2019), resting pools would be required in an NLF fishway that is more than 1,000 feet long. Conservatively assuming that the peak runs overlap, and that 10 percent of the run could be present on any given day, and that 15 percent of the peak day total could be present in the fishway in any given hour; this equates to a potential hourly peak of approximately 25,000 river herring, 2,700 shad, and 180 Atlantic salmon.

Assuming an average herring size of 0.5 lbs, shad size of 4 lbs, and salmon size of 8 lbs (USFWS, 2019), a minimum pool volume of 0.5 cubic feet per pound of fish (USFWS, 2019), and accounting for potential non-target species (10 percent) a total volume of approximately 13,500 cubic feet of water would be required to accommodate the peak run. (By way of comparison, the total residual pool volume provided at Howland was 21,600 cubic feet.) This volume should be provided in the residual volume of the resting pools (volume below the channel invert), with additional small resting areas provided downstream of the roughness boulders.

In summary, based on typical NLF design, following current resource agency criteria, resting pools would likely be required for an NLF at Shawmut, yet the conceptual designs submitted to FERC by MDMR lack resting pools in the two alternatives. Addition of resting pools to the NLF concepts would require either lengthening the fishway (to maintain the current hydraulic gradient) or steepening the gradient (thereby increasing velocities). As noted previously, the feasibility of lengthening the fishway is very low, given the site constraints, thus steepening the hydraulic gradient of the riffles would be the only alternative. Critically, the lack of inclusion of resting pools and the resulting effects on hydraulics in the fishway fails to demonstrate suitable fish passage in the NLF design.

The MDMR NLF conceptual design information filed with FERC neglects to account for, much less limit, any potential loss of renewable energy generation associated with the conceptual designs. Any proposed NLF would need to pass 5% of station capacity (340 cfs) as the minimum flow within the NLF for river flows up to the total of the station capacity and maximum flow in the NLF (7,040 cfs). Beyond that, the inlet flow control structure could be used to incrementally increase the flow in the NLF up to the maximum capacity of the NLF as river flow increases. This maximum NLF flow may also be limited by suitable depths and velocities in the fishway once detailed hydraulic modeling has been completed. For the proposed NLF, the majority of the river flow could be provided through the generating station or the fishway up to approximately 8,500 – 9,000 cfs, or most of the lower half of the fishway operating range.

At flows greater than 9,000 cfs spill via the log sluice or spillway would become a potential for false attraction to migrating fish. One of MDMR's primary expressed concerns during fish passage design for Brookfield's proposed fish lift was false attraction. While providing a total attraction flow of up to 2,000 cfs through the proposed NLF would reduce the potential for spill in May from 65 percent to 55 percent and from 50 percent to 35 percent in June, a significant potential for false attraction remains—as well as the associated concerns for effectiveness of the proposed NLF entrance located downstream of the powerhouse and spillway. The potential for such false attraction was the primary reason that Brookfield's proposed fish lift entrance was located closer to the spillway than the conceptual NLF designs.

SUMMARY

In summary, the NLF conceptual designs lack detailed assessment of fishway hydraulics. Preliminary review of the concepts raises significant concerns for fish passage effectiveness under high and low-flow hydraulics (omission of resting pools, channel slope, and suitability of the proposed fishway for passage by the target species). The NLF concepts do not address physical space constraints, existing infrastructure issues, or potential dam safety issues. In contrast, it is Kleinschmidt's understanding that the proposed Shawmut fish lift was thoroughly sited, reviewed, designed and approved through a detailed and lengthy consultation process with fish passage experts and engineers from NOAA, USFWS, MDMR, MDEP, MDIFW and Brookfield's fish passage engineering consultants. This process resulted in the selection, in full consultation, of the best location and the most effective technology for the Shawmut Project. The MDMR conceptual designs filed with FERC, have not been vetted or developed in consultation with agency fish passage engineers or biologists nor Brookfield. In the absence of these fundamental assessments, the feasibility of the MDMR NLF designs is questionable. And without establishing the basic viability of the NLF designs, there is no basis to recommend an NLF as a viable alternative to be included with the fish passage design already proposed by Brookfield and approved by the agencies. In the event that post-construction studies of the fish lift reveal that additional attraction flow is required, an NLF is not necessarily the only or best way to provide it.

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Technical Memorandum

To: Randy Dorman, Brookfield

From: Greg Allen and Steve Amaral, Alden

Date: October 7, 2021

Re: **Review of Maine Department of Marine Resources' Nature-like Fishway Concepts for the Shawmut Hydroelectric Project (FERC Project No. 2322)**

This memorandum summarizes Alden Research Laboratory Inc.'s (Alden) review of the nature-like fishway (NLF) concepts proposed by the Maine Department of Marine Resources (MDMR) which was filed in their comments to the draft Environmental Assessment (EA) prepared for the Shawmut Hydropower Project (Shawmut, P-2322). MDMR has proposed to replace or supplement Brookfield's current proposed fishways with the NLF concepts. Alden focused the review on the technical merits regarding fish passage performance. A thorough review of other issues (e.g. property ownership, substation interferences, powerhouse access, etc.) is not included but needs be evaluated to ultimately determine feasibility.

A brief description of Brookfield's proposed fishways and relevant design parameters are included for context, as well as discussion of the NLF proposed to replace or supplement fish passage.

Background – Brookfield Proposed Fishways

Alden developed designs for upstream fish passage facilities for the Shawmut project in consultation with resource agencies. A technical design review team was consulted throughout the process consisting of representatives from State and Federal resource agencies[1]. A brief timeline of the design process is provided in Table 1.

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[1] Resource agencies include US Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), Maine Department of Marine Resources (MDMR), Maine Department Inland Fisheries and Wildlife (MIFW) and Maine Department of Environmental Protection (MDEP)

Table 1. Design Timeline

Year	Description
2016	Fish telemetry study Computational Fluid Dynamic (CFD) model study Conceptual design
2017	Preliminary design 30% Design submittal 60% Design submittal Alden design memo
2018	Agency CFD model study request CFD study and design optimization of Unit 7&8 fishway 90% Design submittal Alden design memo
2019	Completion of Issued for Bid Design Documents Completion of Issued for Construction Documents

The fish telemetry study and CFD modeling completed in 2016 aided in the siting of the fishways. The telemetry study (Normandeau 2016) showed that alewife spent the majority of time in the vicinity of the Unit 1-6 powerhouse. Fish were also attracted to the Unit 7&8 powerhouse, but spent much less time there. These results were supported by the CFD modeling (BHH 2016), which showed good far field attraction from flow discharges at the project (i.e., discharge from the two powerhouses). Hence, a fish lift was sited between the spillway and Unit 1-6 powerhouse and a short vertical slot fishway channel was sited in the Unit 7&8 tailrace to allow fish to cross over to the Unit 1-6 powerhouse tailrace and fish lift location.

A fish lift proposed between the spillway and powerhouse was selected due to the space limitations of this area and the track record of success for fish lifts installed at other projects. The fish lift design was developed in accordance with USFWS guidelines (USFWS 2019) and in consultation with the resource agencies. The recently installed fish lift at Milford on the Penobscot River was often referred to by resource agencies as the design to emulate and improve upon during the design consultations for Shawmut.

Relevant fish passage design parameters for the project are provided below.

Project Fish Passage Design Parameters

Target Species and Bypass Reach Fishway Design Populations
(MDMR as cited in NMFS 2016)

Atlantic salmon:	12,000
American shad:	177,000
Alewives:	134,000
Blueback herring:	1,535,000

River flow for fish passage operation

Design high:	20,270 cfs (5% exceedance)
Design Low:	2,540 cfs (95% exceedance)

Powerhouse capacity 6700 cfs

Head pond Elevations

Max:	122 ft (100 yr)
Normal:	112 ft
Design low:	108 ft
Dam crest El.:	108 ft
Flashboard El.:	112 ft

Tailwater Elevation

<u>Unit 1 – 6 Powerhouse</u>

Design high:	91.5 ft
Normal:	89.1 ft
Design low:	88.6 ft

<u>Unit 7&8 Powerhouse</u>

Design high:	90.0 ft
Normal:	87.6 ft
Design low:	87.1 ft

Gross head: 20.5 to 23.4 ft

Proposed Fish Passage Facilities

Fish Lift

Location – North of Unit 1 – 6 powerhouse and adjacent to the spillway
Entrance width – 8 ft
Entrance invert El. – 79.6 ft
Entrance gate – hinged flap gate controlled to provide an entrance differential of 6 to 12 inches with at least a 3 ft water depth.
Hopper volume – 490 ft^3
Fish lift cycle time – 15 min
Total attraction flow – 340 cfs

Unit 7 & 8 Fishway

Location – South of Unit 1 – 6 powerhouse and adjacent to Unit 7 & 8 powerhouse
Channel – 10.5 ft wide by 77 ft long connecting tailraces
Single 42 inch slot baffle
Total head – 1.5 ft
Entrance width – 8 ft
Entrance gate – hinged flap gate controlled to provide an entrance differential of 6 to 12 inches with at least a 3 ft water depth.
Flow – 100 to 140 cfs

Expected Passage Efficiency

Fish lifts have been installed at hydropower dams in Connecticut, Massachusetts, and Maine for passing American Shad, river herring, and Atlantic Salmon upstream. In general, most of these fish lifts are considered effective in passing the target species, with a couple of exceptions (e.g., the Lowell fish lift at the second dam on the Merrimack River in Massachusetts). However, studies have not been conducted at most of these projects to estimate passage efficiency. Issues with attraction and passage through entrance systems have been determined at several sites and efforts are ongoing to improve these conditions for greater passage efficiency (primarily for shad and herring, given restoration of Atlantic Salmon has been abandoned in all New England states other than Maine).

An evaluation of upstream passage of Atlantic Salmon at the Milford Project on the Penobscot River was conducted following its installation in 2014 (Izzo et al. 2016). During the two years of study, passage efficiency of salmon was determined to be 95 and 100%. However, despite study fish locating the fish lift entrance within five hours of arrival at the project, passage delays of a week or more were noted for a large proportion of fish. The results of the Milford study demonstrate that high passage efficiencies can be achieved for Atlantic Salmon using fish lifts, but delays in passage may occur. The occurrence and extent of delays is likely site specific and probably related to entrance design and hydraulic conditions, among other factors (e.g., light/shadows, noise, and magnitude and location of any competing flows).

Passage effectiveness studies have also been conducted with river herring at Milford in 2015, 2019, and 2021. The results of the 2015 study were inconclusive due to most of the radio-tagged fish falling back downstream after release and not returning upstream. The 2019 study produced an overall passage efficiency of 65%, but this was a proof-of-concept evaluation for improved tagging techniques and does not account for any test-related bias, tag loss, or natural mortality. The results for the 2021 study are not yet available. Upstream movement of shad in the lower Penobscot has been investigated by University of Maine researchers, but very few tagged study fish have been detected approaching or passing Milford.

Based on high passage numbers of shad and herring at fish lifts installed at several dams on other large rivers on the east coast (including very high passage numbers for river herring at several projects in Maine), it is expected that a fish lift at Shawmut could also pass high numbers of these species and would likely have passage efficiencies similar to or greater than other fishway designs. The ability of lifts to effectively pass a wide range of species of varying sizes and swimming abilities, including those targeted for passage at Shawmut, often make this technology the preferred approach for passing fish upstream at hydropower dams.

Nature-like Fishway Review

The NLF concepts presented by MDMR are described in a memo dated July 20, 2021, from Interfluve titled Nature-like Fishway Conceptual Analysis, Shawmut Dam, Kennebec River, Maine (Interfluve 2021). Two conceptual layouts were presented both with an entrance downstream of the Unit 7&8 tailrace approximately 650 ft downstream of the spillway. The alignment extends upstream from the entrance west of the project structures between the existing substation and railroad with an exit approximately 360 ft upstream of the existing head gate structure. The total length of the alignment is approximately 1250 ft and the two concepts are similar but with different widths, 100 and 80 ft. Relevant features reported from the designs are provided below.

NLF Features

Length:	1250 ft (full length)
	1150 ft (to hydraulic control structure)
Wetted width:	100 ft and 80 ft (max and reduced width concepts)
Max top width:	170 ft
Entrance invert elevation:	85 ft
Exit invert elevation:	107 ft
Channel bed slope:	1.7%

The design water levels for the head pond and tailwater should be similar to the design parameters for the fish lift. Control of the head pond is maintained at elevation 112 ft with the use of the flashboards, rubber dams, log sluice and unit flows over the range of fish passage design river flows (95% exceedance to 5% exceedance). The dam crest is at elevation 108 ft which represents a low flow condition if the hinged flashboards are down. The location of the NLF entrance is downstream of the Unit 7&8 tailrace and based on previous CFD modeling, we estimate an approximately 0.5 ft lower water surface elevation than the elevations at the Unit 7&8 powerhouse. The following design conditions for the NLF were determined based on current project information.

Design Conditions

Head pond water levels

Max:	122 ft (100 yr)
High:	112 ft
Normal:	112 ft (top of flashboards)
Design low:	108 ft (dam crest)

Tailwater levels

Estimated at NLF entrance location assumed to be 0.5 ft less than Unit 7&8 powerhouse levels.

Design high:	89.5 ft
Normal:	87.1 ft
Design low:	86.6 ft

Gross head: 22.5 to 25.4 ft

NLF Hydraulic Slope

High river flow:	1.8 %,
	2.0 % (w/ hydraulic control)
Normal:	2.0 %,
	2.2 % (w/ hydraulic control)
Low river flow:	2.0 %
	2.2 % (w/ hydraulic control)

Reported hydraulic capacity

Maximized width option	1600 – 2400 cfs (wetted width approximately 100 ft)
Reduced width option	1500 – 2000 cfs (wetted width approximately 80 ft)

Comments

NLF as a Fish Passage Technology

Nature-like fishway channels are a relatively new technology for fish passage and there have been very few evaluations of fish passage effectiveness. USFWS fish passage guidelines (USFWS 2019) recommend slopes less than 3% for roughened channels, which is the type of NLF channel proposed for Shawmut. Alden's hydraulic modeling experience evaluating a roughened channel suggests shallower slopes are needed to provide acceptable velocity conditions for shad and river herring. Alden recommends a slope less than 2%, but ideally 1.5 % to provide acceptable velocity conditions over a range of flow conditions. Without hydraulic modeling as part of the design process, Alden cannot confirm appropriate hydraulic conditions throughout the fishway for the targeted species.

The total head of 25 ft is greater than any other NLF installed and results in a length of 1250 ft. The design is unprecedented in scale and presents significant risk without performance data from installed projects. While the Howland bypass channel is cited as an analog for the proposed design, no information is available as to the effectiveness of this design in passing anadromous species upstream. Further, the proposed design deviates significantly from several key parameters of the Howland bypass channel, which has a slope of 1.5%, a total head of 16 ft, and a length of 1000 ft. The only other site where a similar sized NLF was installed and evaluated was at the Herting Dam in Sweden (about 15 ft of head, a length of 1,500 ft, and a slope on the order of 1%). Atlantic Salmon passage efficiency was estimated to be 97% at this site. Given the unprecedented scale and lack of data from similar sites (particularly for shad and herring), the proposed NLF should be considered an experimental technology with respect to its potential application at Shawmut.

Expected Performance

Nature-like fishways designed specifically for salmonids and/or shad and herring have had fewer installations compared to more technical fish passage designs (e.g., vertical slot, pool and weir). However, recent research on the swimming capabilities and behavior of upstream migrating shad and herring has increased the interest in the use of nature-like fishways for these species and guidelines for their design have been developed (Turek et al. 2016). Assuming appropriate slopes, depths, and velocities throughout an NLF designed for Shawmut, internal passage efficiencies likely would be relatively high for American Shad (> 70%), river herring (> 80%), and Atlantic Salmon (> 90%). However, the location of the NLF entrance in the conceptual designs for Shawmut is about 650 ft downstream of the dam on the right bank. Depending on flow conditions (i.e., presence of flow from powerhouse and/or spillway) many upstream upstream migrants could be attracted to the turbine discharges or spill. Also, the length and slope of the NLF conceptual designs for Shawmut may exceed what is required for acceptable levels of passage efficiency of shad and herring. Depending on the passage efficiency of an NLF, it is possible that having an NLF and a fish lift at Shawmut could be less efficient at passing fish upstream than having only a fish lift with respect to total passage numbers and the potential for migration delay.

Few studies have evaluated passage efficiency of NLF designs for American Shad, river herring, and Atlantic Salmon. Laboratory studies that have evaluated NLF designs in the lab and field with shad and herring have reported a wide range of efficiencies (0-94%; Table 2). These studies have only been conducted for NLF channels with slopes between 3.5 to 6.7% and passage efficiencies at these slopes typically were 65% or less. NLF designs with relatively short lengths (110 ft and less) had the highest efficiencies. The longest length for which passage efficiency was evaluated with one of the Shawmut target species (shad) was 300 ft (with slopes of 3.5 to 5.0%); efficiency for shad at this site was reported to be 53 to 65%. The only NLF with a length close to the alternative designs developed for Shawmut is the Howland Bypass on the

Penobscot River, which is 1,050 ft in length and has a slope of 1.5%. This length is about 25% shorter than what has been proposed for Shawmut. Given the relatively low passage efficiencies reported for shad and herring at higher slopes (3% and greater) and shorter channel lengths, slopes greater than 1.5% probably should not be considered for Shawmut and thus, any NLF meeting the necessary slope for expected passage of shad would need to be in excess of 1,650 ft long, approximately 100 ft longer than MDMR’s proposed design.

Table 2. Summary of design information and effectiveness studies for NLF fishways

Site	River	State/ Country	Total Head (ft)	Slope (%)	Length (ft)	Species	Passage Efficiency (%)	Source
Shawmut Dam	Kennebec	ME	25.0	2.0	1,566	Atlantic Salmon, river herring, American Shad	--	Interfluve 2021
Howland Bypass	Piscataquis	ME	16.0	1.5	1,050	Atlantic Salmon, river herring, American Shad, American Eel, and Sea Lamprey	--	--
Town Brook	Town Brook	MA	12.0	5.0	105	Alewife	94	Haro et al. 2008; Franklin et al. 2012
East River	East River	CT	--	6.7	160	Alewife	40.6	Haro et al. 2008; Franklin et al. 2013
Conte Lab Study	Connecticut	MA	5.5	5.0	110	American Shad Blueback herring	40-90 0-40	Haro et al. 2008
Saccarappa East Channel Saccarappa West Channel	Presumpscot	ME	9.0 9.0	2.0 1.5	300 500	American Shad, river herring, and American eel	--	Alden design documents
Cape Fear River	Cape Fear	NC	13.0	3.5-5.0	200 - 300	American Shad	63-65	Raabe et al. 2019
Herting Dam	Altran	Sweden	15.3	--	1,476	Atlantic Salmon	97	Nyqvist et al. 2017
Springs Dam	Saco	ME	5.2	3.0	230	American Shad and river herring	--	--

NLF Conceptual Designs and Evaluated Scenarios

As mentioned previously, the NLF was designed as large as possible within the site space constraints using the Howland Bypass NLF as an example. The concepts were developed to maximize flow volume to enhance attraction to the fishway, particularly when the river flow exceeds the station capacity (6700 cfs). Comments are provided for the following scenarios:

Scenario A - NLF to supplement Brookfield's currently planned fishways

Scenario B - NLF to replace Brookfield's currently planned fishways

Scenario C - NLF installed with project decommissioning

Scenario A – Nature-like fishway to supplement currently proposed fish passage facilities

The Interfluve memo states the NLF could be considered to supplement or as an alternative to the proposed fish passage facilities. This scenario assumes the proposed fish lift between the old powerhouse and spillway would be installed and the fishway channel connecting the two powerhouse tailraces would be installed. This scenario would include the following fish passage flows:

- Fish lift: 340 cfs
- Tailrace fishway channel: 80 to 100 cfs
- NLF: 1500 to 2400 cfs

The fish lift is ideally located at the confluence of the spillway and old powerhouse. This is the most upstream location and the existing powerhouse provides far-field attraction as shown in the fish telemetry study (Normandeau 2016) and CFD study (BHH 2016). The addition of the NLF may or may not benefit upstream passage performance under this scenario, depending on project operation, river flow conditions, actual NLF performance, and potential delay due to NLF entrance location. The entrance to the NLF is approximately 650 ft downstream of the dam on the right bank. Fish approaching the project along the right side of the river will have an opportunity to find the NLF entrance. Fish that swim past the entrance due to attraction to the powerhouse flows will have the opportunity to find the fish lift entrance.

The Interfluve memo does not directly provide a recommendation for the operation of the project facilities and the NLF. If the NLF were to operate passively, as the memo states as the preference, without flow control, it would curtail generation at river flows less than 9440 cfs. This in turn would reduce the far field attraction to the fish lift, due to lower powerhouse flows and the NLF would represent a greater percentage of the overall river flow. This should increase attraction to the NLF and the overall performance of the NLF. However, this may not increase the overall performance of upstream passage at the project and could potentially decrease performance due inferior internal fishway effectiveness of the NLF or due to delay of fish finding the NLF entrance. Given the lack of data to assess the internal effectiveness of the NLF, the uncertainty of the entrance location and the available performance data for the fish lift technology, we recommend operational preference to the fish lift.

If preference is given to the fish lift passage facilities the NLF would require a flow control structure to limit flows once the river flow falls below 9440 cfs. This would ensure continued attraction to the fish lift entrance. At river flows greater than the station capacity, the NLF flows would increase. The NLF would provide a benefit at higher river flows by providing a greater percentage of fish passage attraction which may decrease overall fish passage delay at the project.

Alden cannot recommend this scenario at this time due to a lack of information. The incremental benefit of the NLF is uncertain due to lack of performance data and uncertainty regarding attraction to the entrance. To reduce the uncertainty would require additional fish telemetry studies at greater river flows, CFD modeling of the NLF entrance conditions, and obtaining actual performance data for NLF projects such as the Howland Bypass.

Scenario B – Nature-like fishway to replace proposed fish passage facilities

This NLF concept would replace the currently proposed fish passage facilities, yet maintain operation of generating facilities. The performance of the NLF would be critically dependent on the ability to attract fish to the entrance and successfully ascend the NLF. The large scale design, similar to the Howland Bypass, relies on flow volume to attract fish to the entrance. The USFWS recommends that the fishway entrance be located immediately downstream of the barrier or adjacent to the dominant source of far field attraction flow (e.g. powerhouse discharge, spillway) (USFWS 2019). The NLF entrance is 650 ft downstream of the dam and main powerhouse, not immediately downstream of the spillway. Fish that continue past the entrance and are attracted to the powerhouse flows may not find the entrance or could be significantly delayed. Unlike the fish lift proposal, which provides a supplemental vertical slot fishway to relocate fish attracted to the competing Unit 7&8 powerhouse flows, the NLF would make no accommodations for the fish attracted to the main powerhouse flows. The NLF would perform best, in terms of attraction, at lower river flows with no competing powerhouse flows.

Alden does not recommend this scenario, as it is likely to be inferior in performance compared to the currently proposed fish passage facilities. This scenario is expected to cause significant delay due to the entrance location and competing powerhouse flows.

Scenario C – Nature-like fishway and decommissioning of hydropower project

In this scenario the generating facilities would be decommissioned and the dam would remain. Active operation of project discharge at the dam would cease and flows would discharge passively over the spillway. The NLF would also operate passively and the head pond would fluctuate with river flows as there would be no active control of project discharge via use of gates. Similar to Scenario B, fish that swim past the NLF entrance attracted to the spillway may not find the NLF entrance or would be significantly delayed. This option has the disadvantage of distributing river flow across the entire length of the spillway rather than concentrating flows from a powerhouse, which in turn aides in far field attraction to a fishway.

Alden does not recommend this scenario, which is expected to be less effective than the currently proposed fish passage facilities. In addition, this scenario is expected to be less effective than either of the previous two scenarios in terms of fish attraction. This alternative is expected to cause significant delay due to the entrance location and lack of bulk attraction provided by gates and powerhouse flows. This scenario would perform best during low river flows when there is less competing flows from the spillway.

Summary of Alden's Comments and Recommendations for MDMR's proposed NLF for Shawmut

- The proposed NLF would be less effective than Brookfield's proposed fish passage facilities based on the entrance location, anticipated length given expected slope, and lack of available effectiveness studies. The proposed fish lift is a proven state-of-the-art technology designed with resource agency consultation using Milford as an example to emulate/ improve throughout the design process.
- More data on NLF effectiveness are needed to determine the ability to meet fish passage performance requirements at Shawmut.
- NLF as a fish passage technology is experimental for the unprecedented scale proposed for Shawmut.
- Alden recommends a slope of less than 2% and ideally 1.5% to meet hydraulic requirements of the target species. The design process should include hydraulic modeling and comparison to swimming capabilities of the target species.
- Scenario A – NLF to complement proposed fish passage facilities (fish lift). In this scenario priority should be given to the fish lift and the Unit 1 - 6 powerhouse flows to attract fish to the lift. There is significant uncertainty with the performance of the NLF and curtailing powerhouse flows for the sake of the NLF operation may hinder overall fish passage performance at the site due to unknown internal effectiveness.
- Scenario B – NLF to replace proposed fish passage facilities. The entrance to the NLF is located a significant distance (650 ft) downstream of the dam. Fish are likely to experience significant delay with competing flows from the powerhouse and spillway which will attract fish a large distance away from the NLF entrance. This scenario is expected to be less effective than Scenario A and the current proposed fish passage facilities due to entrance location, entrance attraction and unknown internal effectiveness.

- Scenario C – NLF installed with project decommissioning. This scenario is expected to be less effective than Scenario A, B and the current proposed fish passage facilities, due to lack of controlled project discharge, entrance location, and unknown internal effectiveness. River flow would be discharged passively over the entire length of the dam.

This memo focused solely on the merits of fish passage and did not include other potential issues that impact the overall feasibility of the NLF alternative, such as property ownership, setbacks from railroad and residence, utility interferences, site access, flood conditions, etc.

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USFWS (U.S. Fish and Wildlife Service). 2019. Fish Passage Engineering Design Criteria. USFWS, Northeast Region R5, Hadley, MA.

c) Shawmut Project Updated Review of Run of River Operations

MEMORANDUM

To: Randall Dorman – Brookfield Renewable

From: Jennifer Jones, P.E. – Kleinschmidt

Date: October 13, 2021 **Document No.** 3758018.01

Re: Shawmut Hydroelectric Project (FERC No. 2322-060) Run of River Analysis

On July 1, 2021, the Federal Energy Regulatory Commission (FERC) issued its Draft Environmental Assessment (DEA) for the Shawmut Hydroelectric Project (Project) (FERC No. 2322). On August 16, 2021, the Kennebec Coalition (Coalition) filed comments on the DEA wherein, they claimed that FERC failed to analyze run-of-river issues, and suggested that the Shawmut Project is not operated as run-of-river. On August 11, the Maine Department of Environmental Protection (MDEP) issued a draft Water Quality Certification order (Draft WQC Order) for the Shawmut Project. In response to that draft, the Coalition submitted a letter dated August 18, 2021 commenting on the Draft WQC Order of the water quality certification. Comment number 2 in the letter that claims the Shawmut Project does not operate as a "run-of-river" facility. This supplemental filing provides additional information in response to these comments regarding run-of-river operations at the Shawmut Project.

Comment 2 of the Coalition's letter claims that the Project is not operated as a "run-of-river" facility. This memo uses Shawmut Project operating records and historic data on impoundment levels to show the daily, monthly, and annual elevations and fluctuations while operating under "run-of-river" operation. The hourly pond level and total outflow records for the Shawmut Project for the period 2001 through 2020 were compiled. Data obtained from the USGS website were used to develop daily average inflows at Shawmut. The inflow values were obtained from the Madison, Maine USGS gage and the Mercer, Maine USGS gage for the period 2009 through 2020; these gage data have been prorated by drainage area to illustrate inflow to the Shawmut Project.[1] The above data have been plotted by quarter year intervals and are attached in PDF format.

Review of the plots illustrates that the long term operation of the Project is consistent with expectations for run-of-river operations where the pond level management targets the normal full pond elevation of 112'. Pond level variations during normal daily

[1] Gage number 01047150 was installed in 2009 and is located 26 miles upstream from the Shawmut dam. The intervening drainage between the location of the Madison gage and the Shawmut dam includes the Sandy River, Wesserunsett Stream and local drainages including Martin and Carrabassett Streams.

operations are generally within a foot of full pond which allows a margin for wave action, variable inflows and time to adjust project unit, gate and spillway settings.
The pond level is generally maintained by managing project outflow through use of the turbine-generator units, the limited gate capacity of the Project (forebay gates and former log sluice gate), the permanent hinged flashboard sections, and/or the spillway section.

The attached plots illustrate that the total Project outflow varies somewhat on a short-term basis as various units, gates, and spillway mechanisms are opened or closed to manage pond levels within a run-of-river mode (i.e. limit pond level variations during normal operations to within a reasonable degree). For example, three typical operational changes are observable on the plots:

- Units are turned on or off to accommodate changes in inflow and/or pond level. Units 1-6 typically operate in the approximate range of 650 cfs each, units 7-8 typically operate in the approximate range of 1,300 cfs each.

- Night time shutdown for eel passage. Since the fall of 2009, Units 7 and 8 have been shut down for 8 hours each night for a six week period between September 15 and November 15 to provide for the safe passage of downstream migrating eels. Depending on available inflow and pond level (spillage or not), these shutdowns and morning startups can change outflows by up to 2,600 cfs.

- The rubber dam (inflatable bladder) sections are deflated to accommodate changes in inflow and/or pond level. Since completion of the rubber dam sections in the fall of 2009, and depending on the current inflow compared to the total station hydraulic capacity, management of the pond level by short term operation of the bladder sections can change short term outflow by up to 7,000 cfs per bladder.

The Coalition’s comment letter did specifically note several instances where they have noted short-term fluctuations in project discharge of 1,000 cfs of more. An example of the fluctuations noted are shown in the plot below between August and September 2018. The discharge values appear to rise and fall by 600-1,000 cfs for multiple days during this period. While the discharge appears to rise and fall significantly, the pond elevation remains constant. These fluctuations in discharge are the result of unit operations, switching between different units to optimize Project operations and maintain a relatively constant headpond elevation. When the headpond is being maintained, there is no significant storage that is being utilized. In the case for the period shown below, the headpond averages 112.0 feet and fluctuates less than 0.4 feet for the period between 8/13 and 9/21, indicating that storage is not being used and run-of-river conditions are being met.

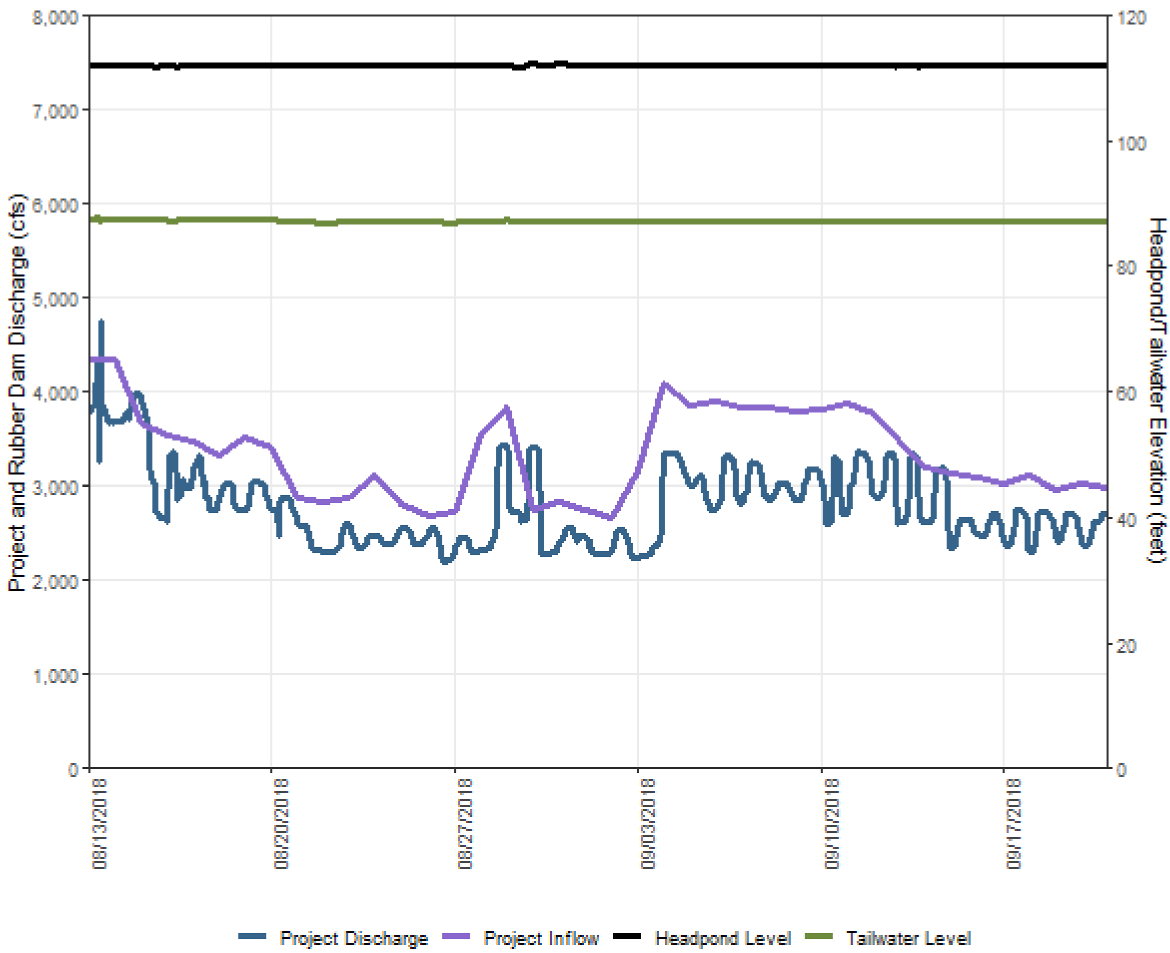
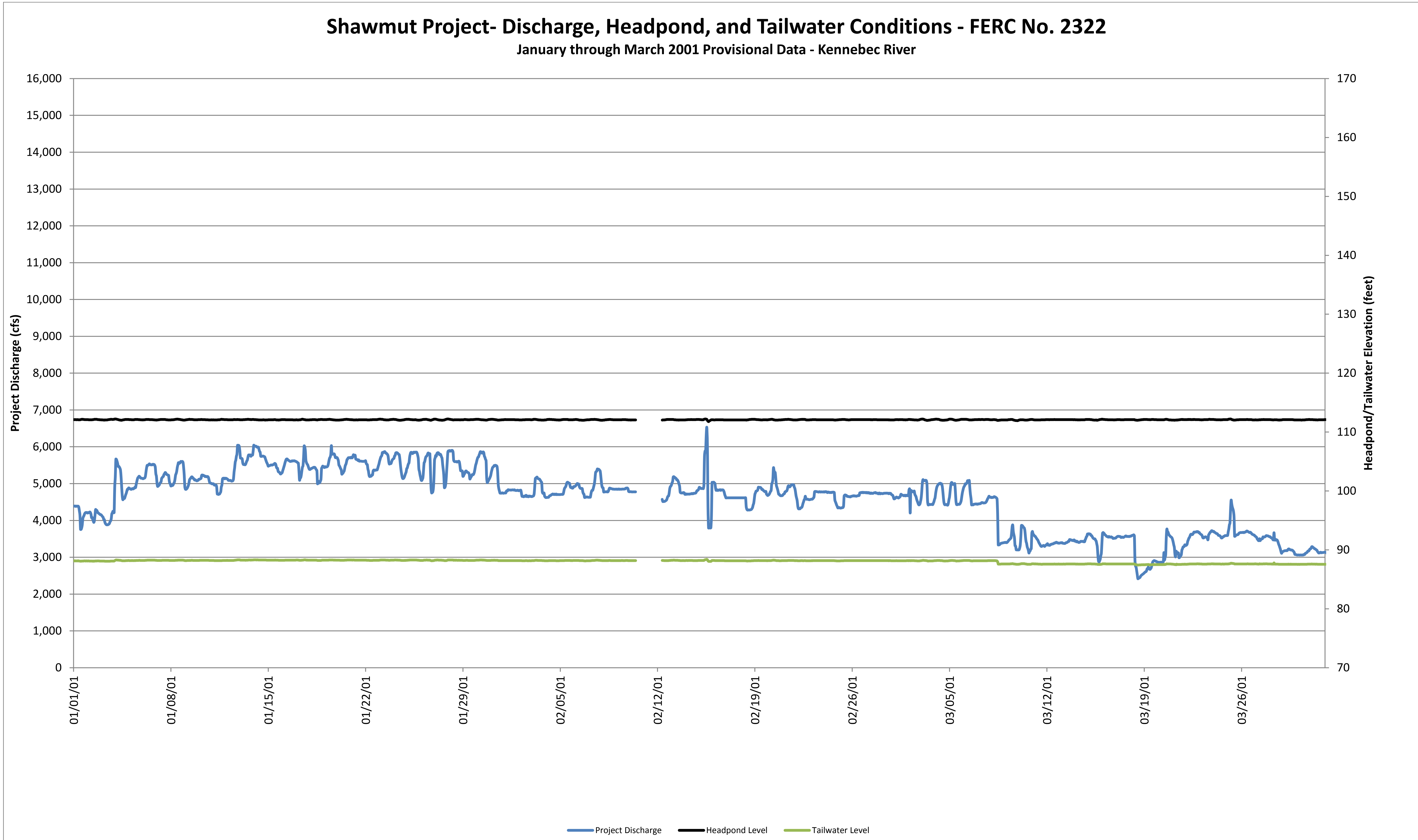


FIGURE 1 - SHAWMUT DISCHARGE, HEADPOND, TAILWATER: 8-13-2018 THROUGH 9-21-2018

Overall, the total Project outflow closely tracks the total Project inflow, as illustrated by the estimated inflow from the Madison and Mercer gage data, while managing the pond level to reduce daily pond level variations to the extent reasonable. Note that the gage data is prorated by drainage area to the Project site; while the resulting data is representative over the long term it may or may not precisely calculate actual daily inflow during certain periods, particularly during natural low flow periods when the unregulated tributaries are not contributing significantly to the overall river flow.

Attachment: Historical Flow and Reservoir Level Data

Historical Flow and Reservoir Level Data



Shawmut Project- Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2001 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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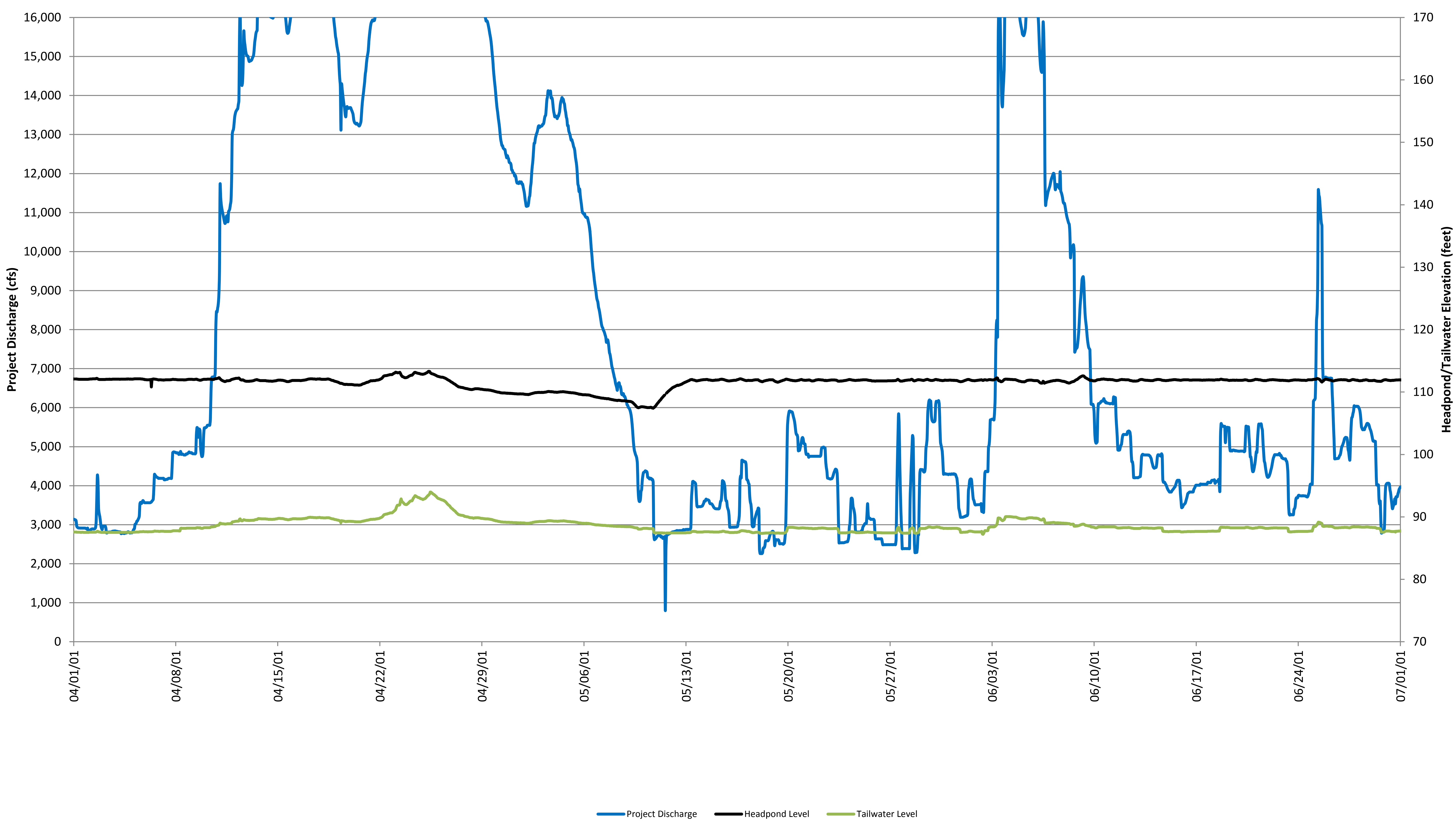
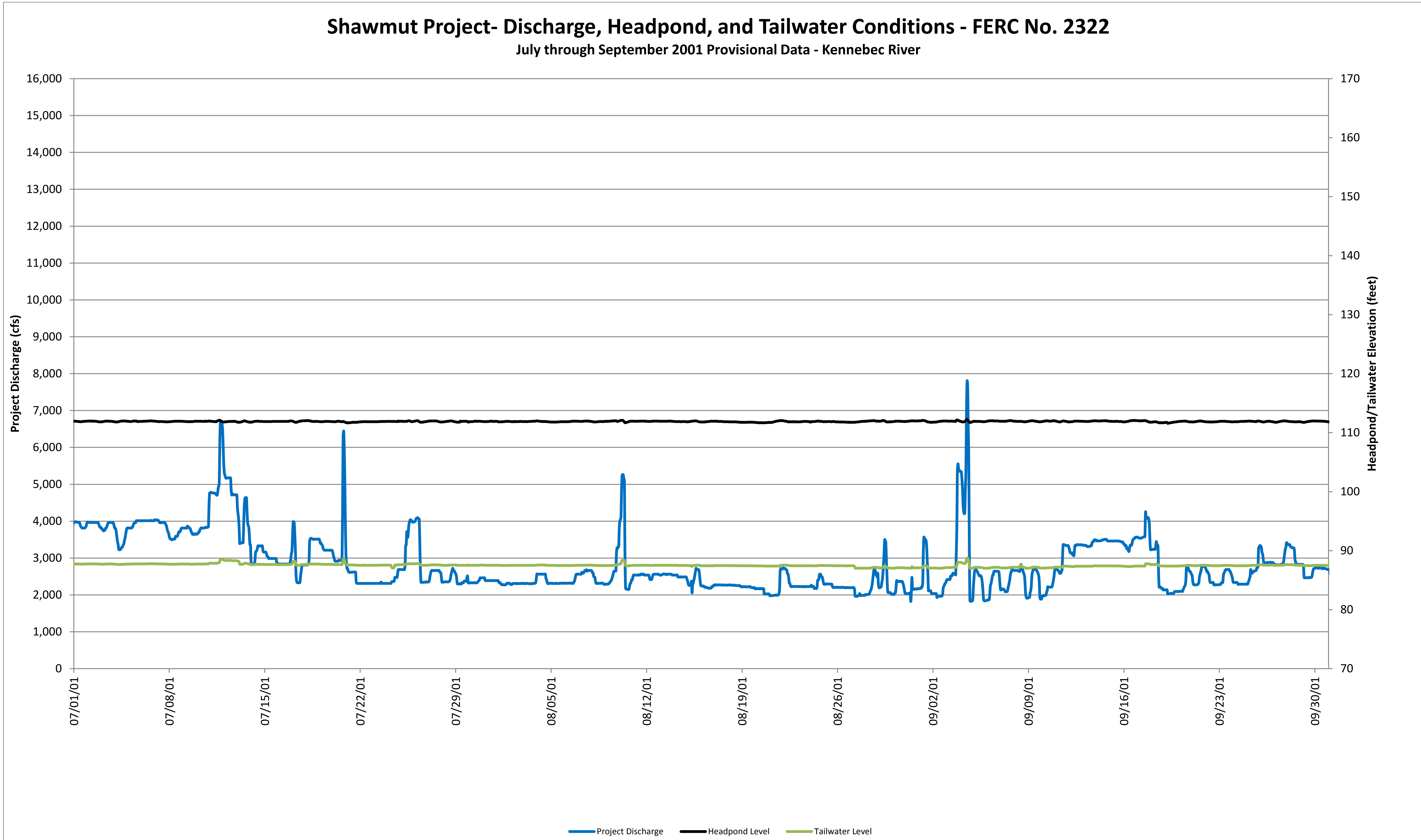
Project Discharge
Headpond Level
Tailwater Level

Shawmut Project- Discharge, Headpond, and Tailwater Conditions - FERC No. 2322

April through June 2001 Provisional Data - Kennebec River

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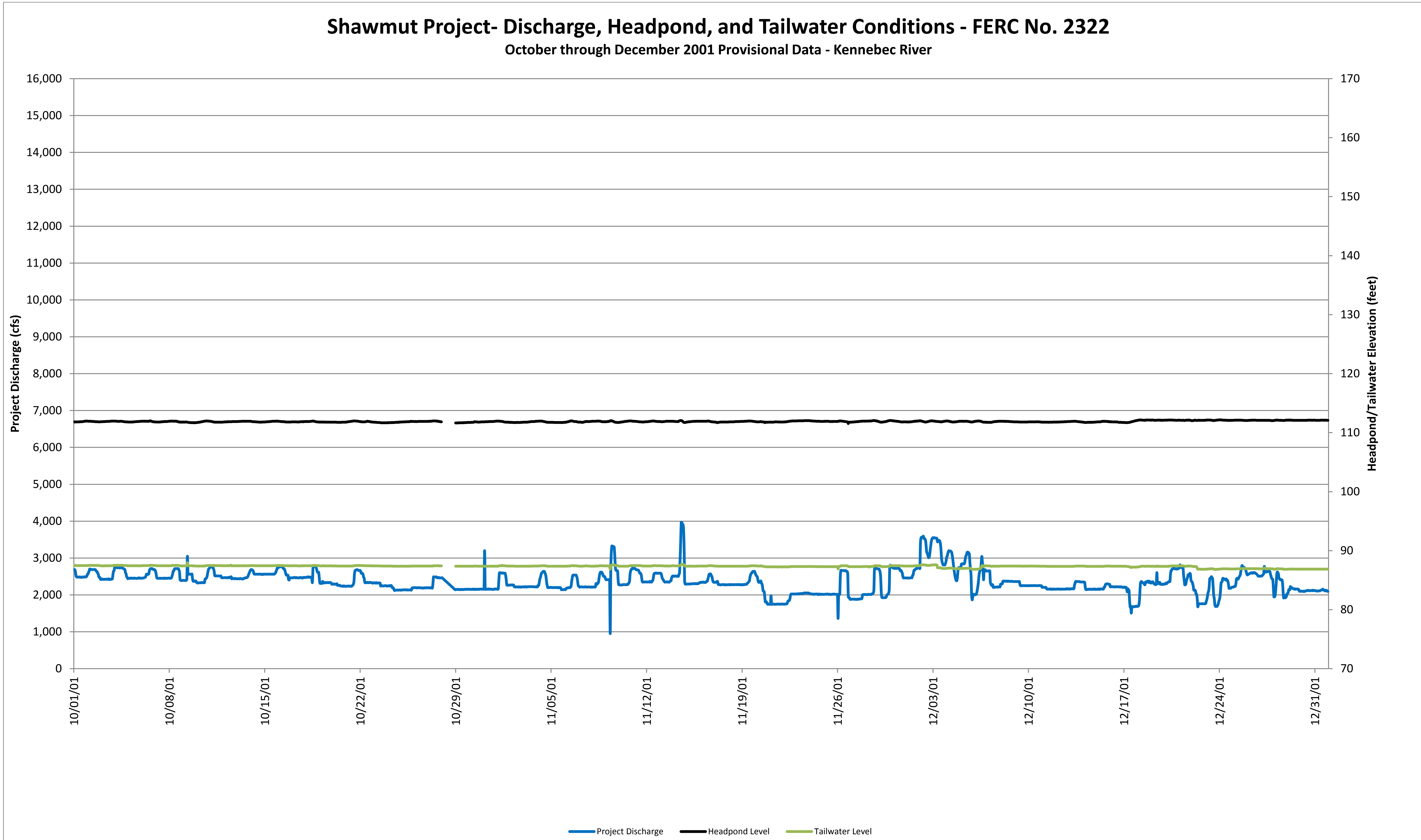
Project Discharge
Headpond Level
Tailwater Level



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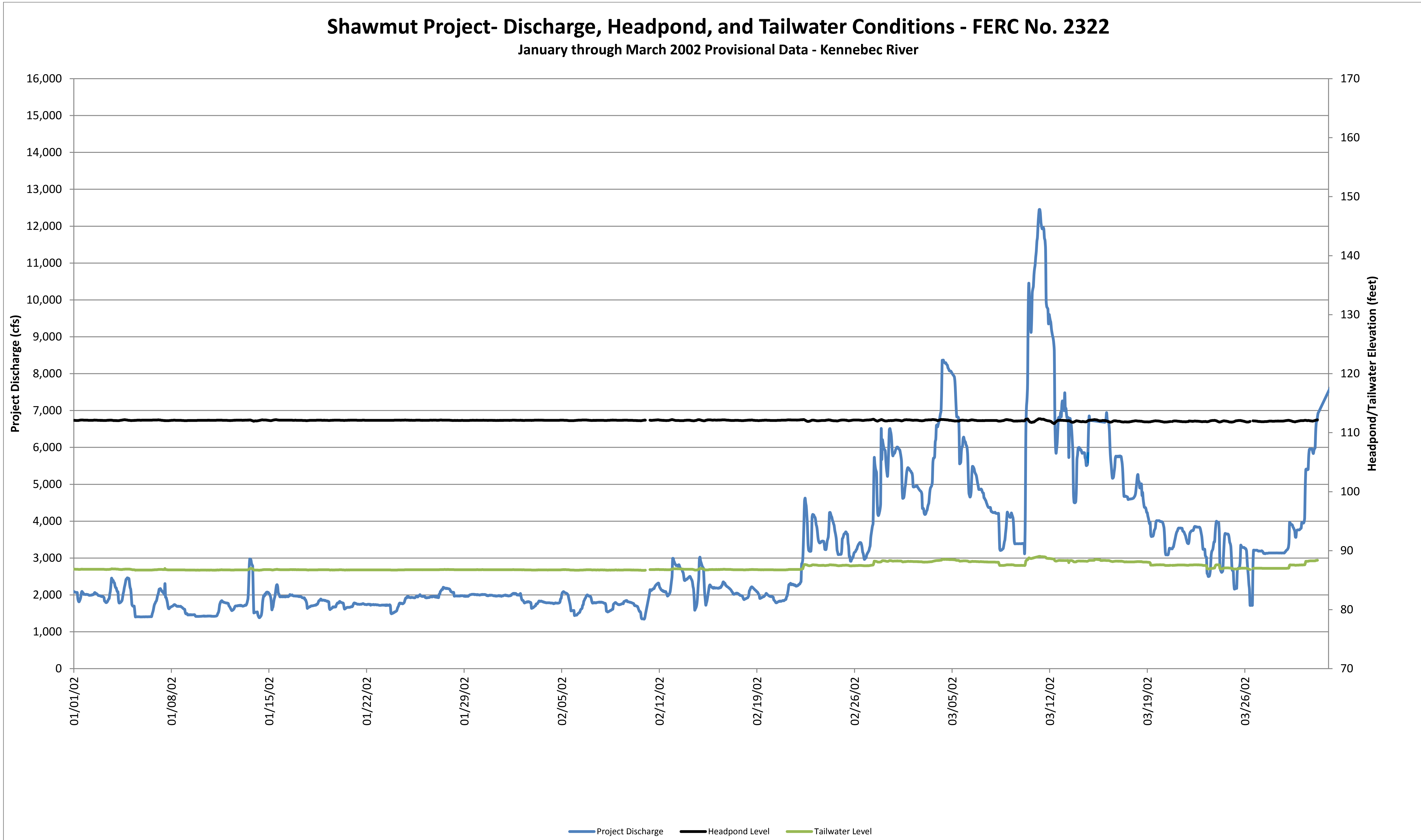

Shawmut Project- Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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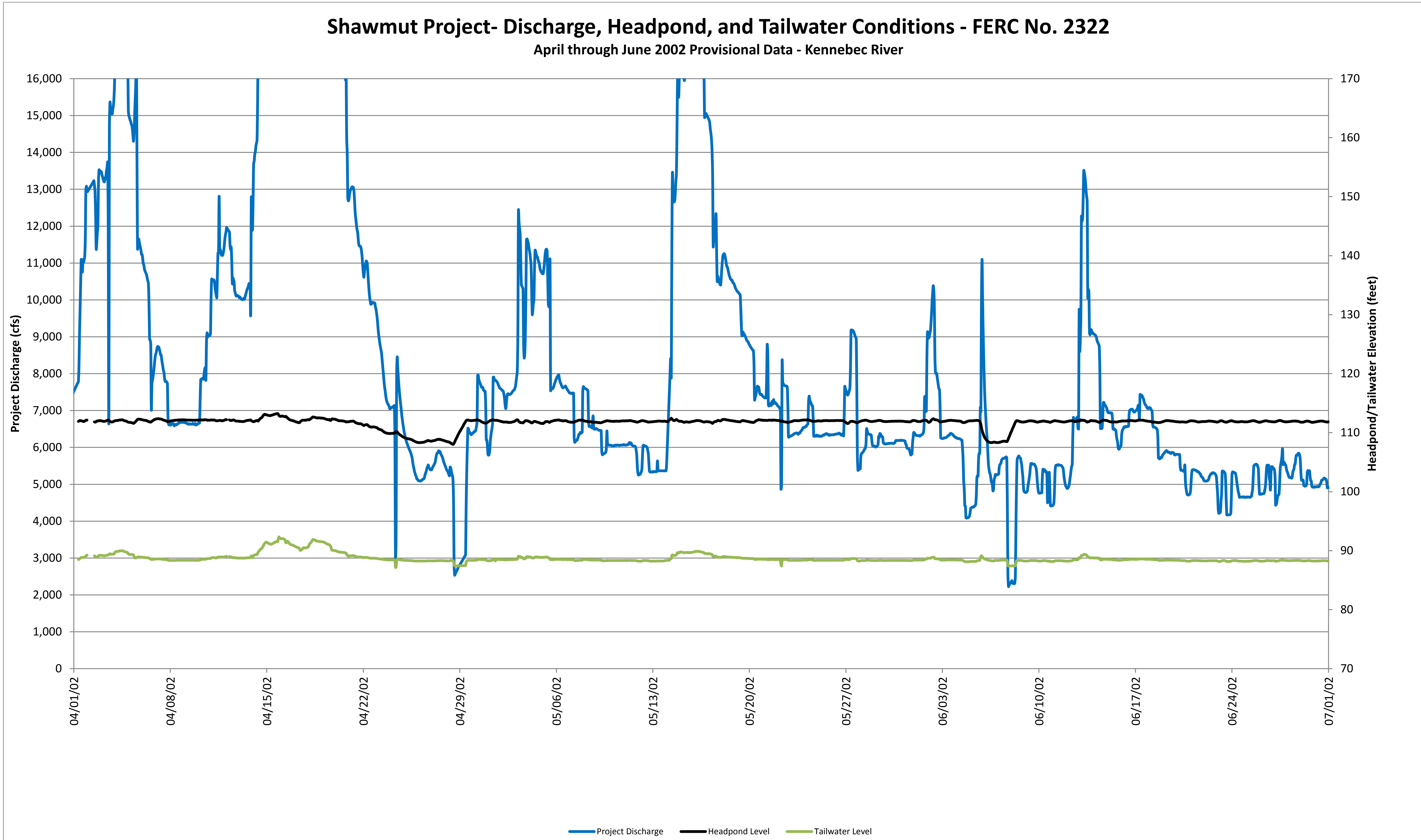
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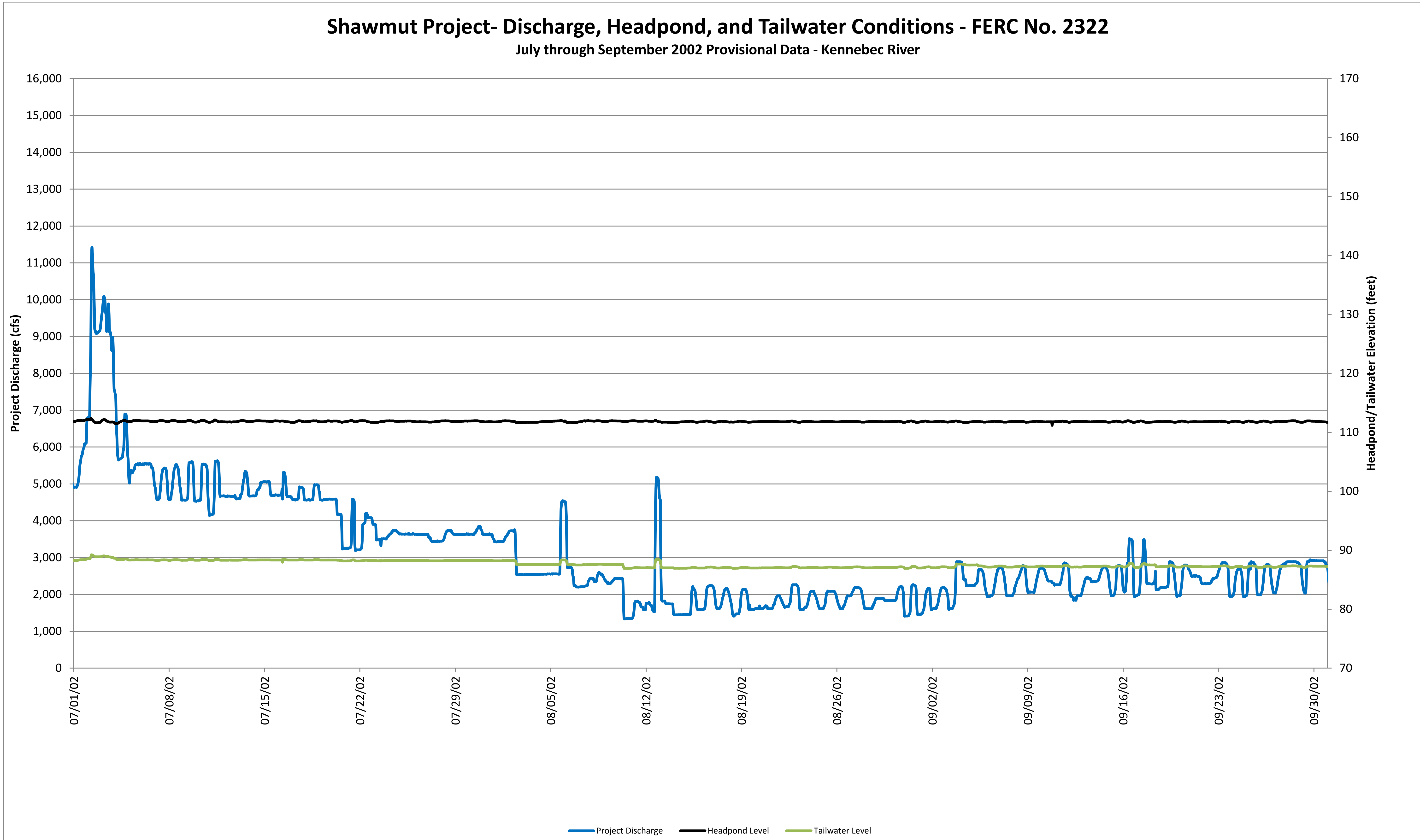

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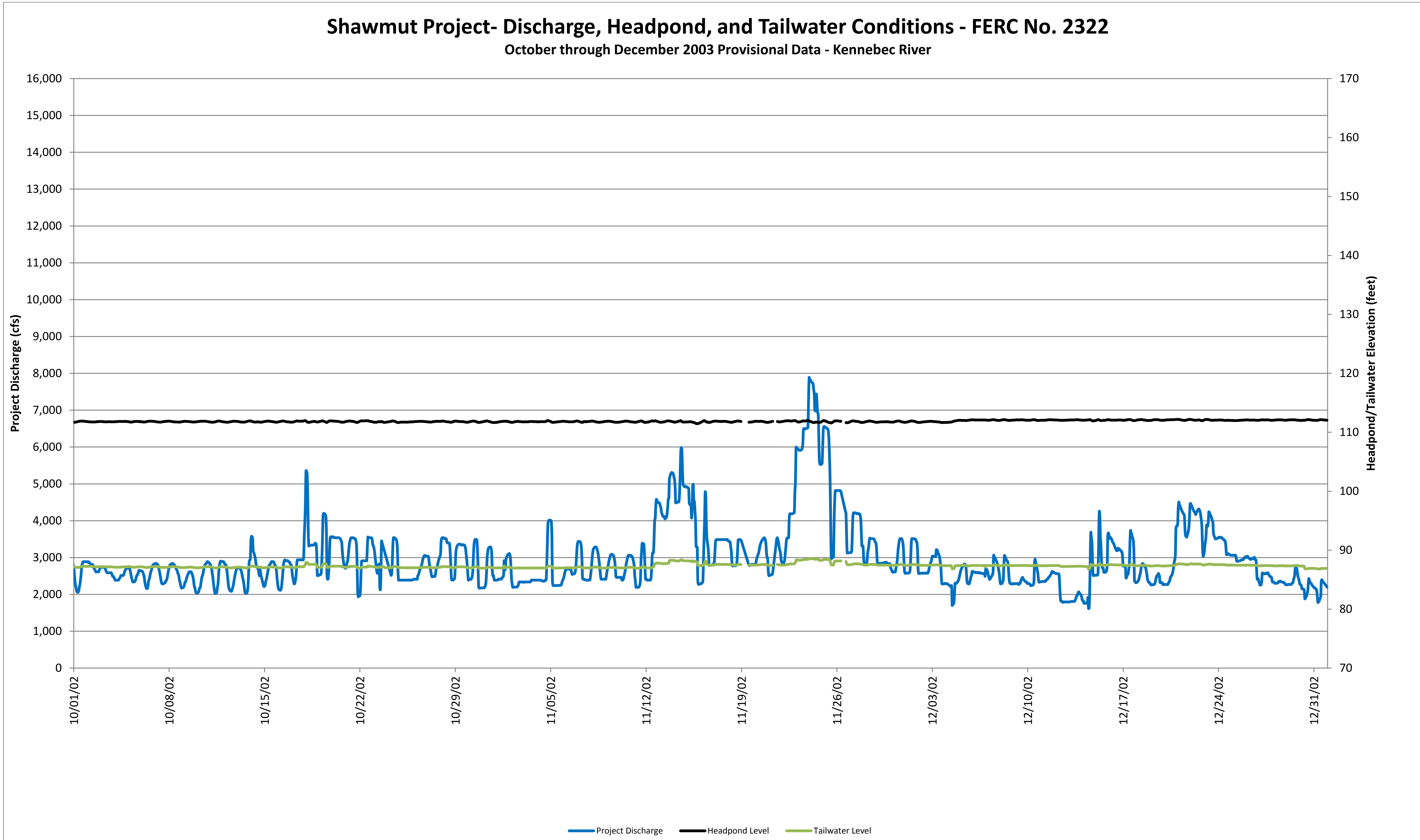
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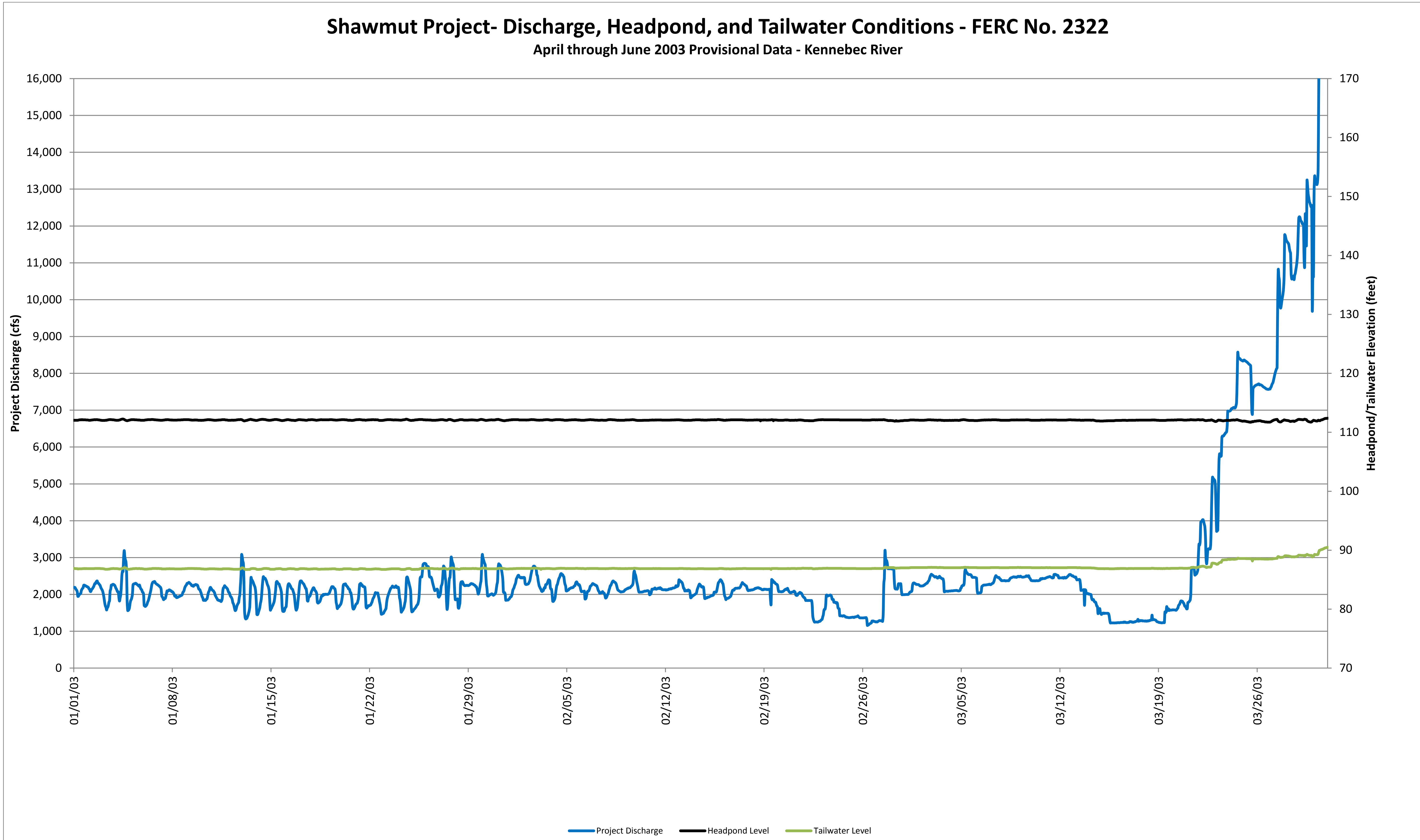

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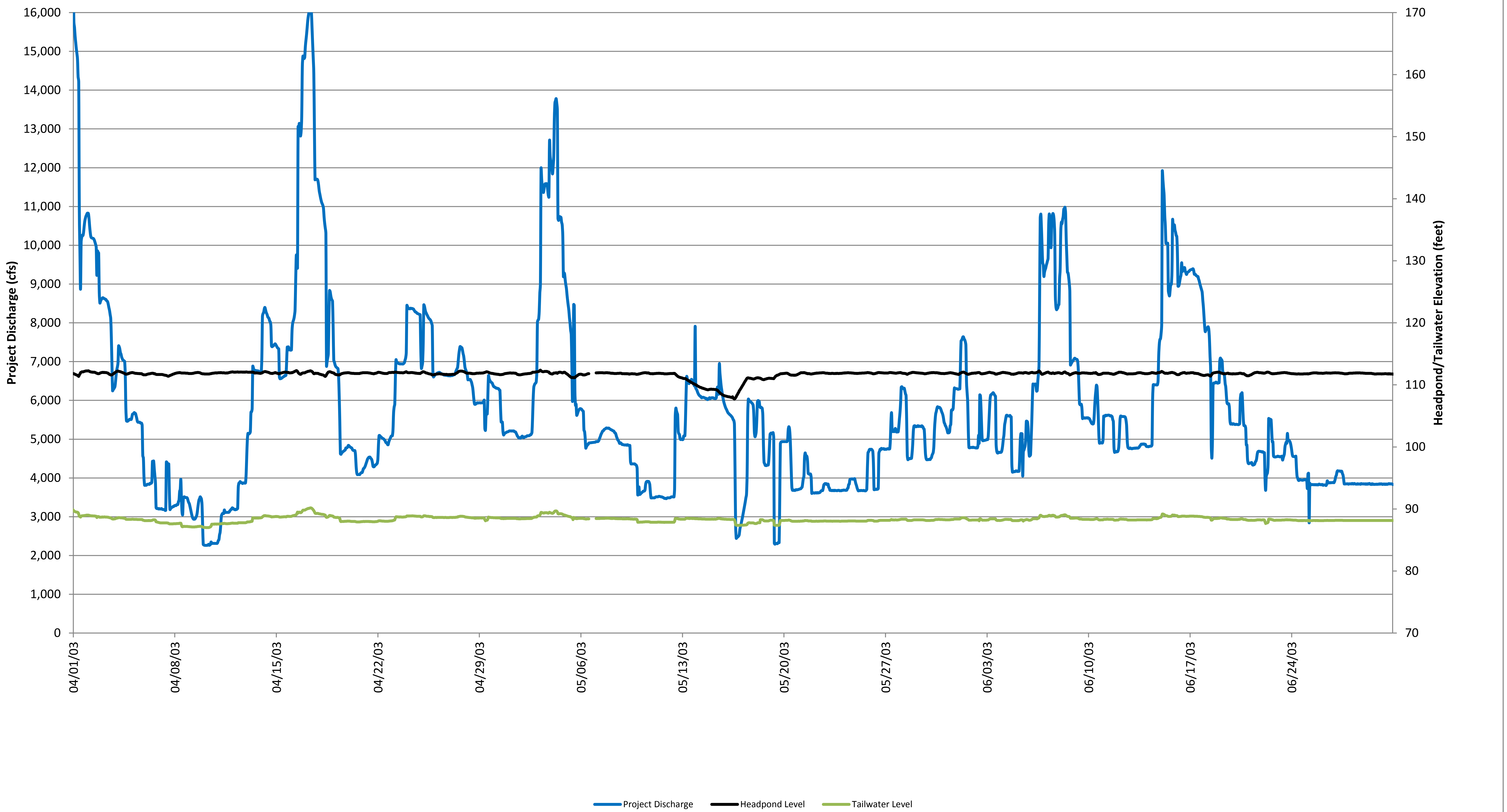

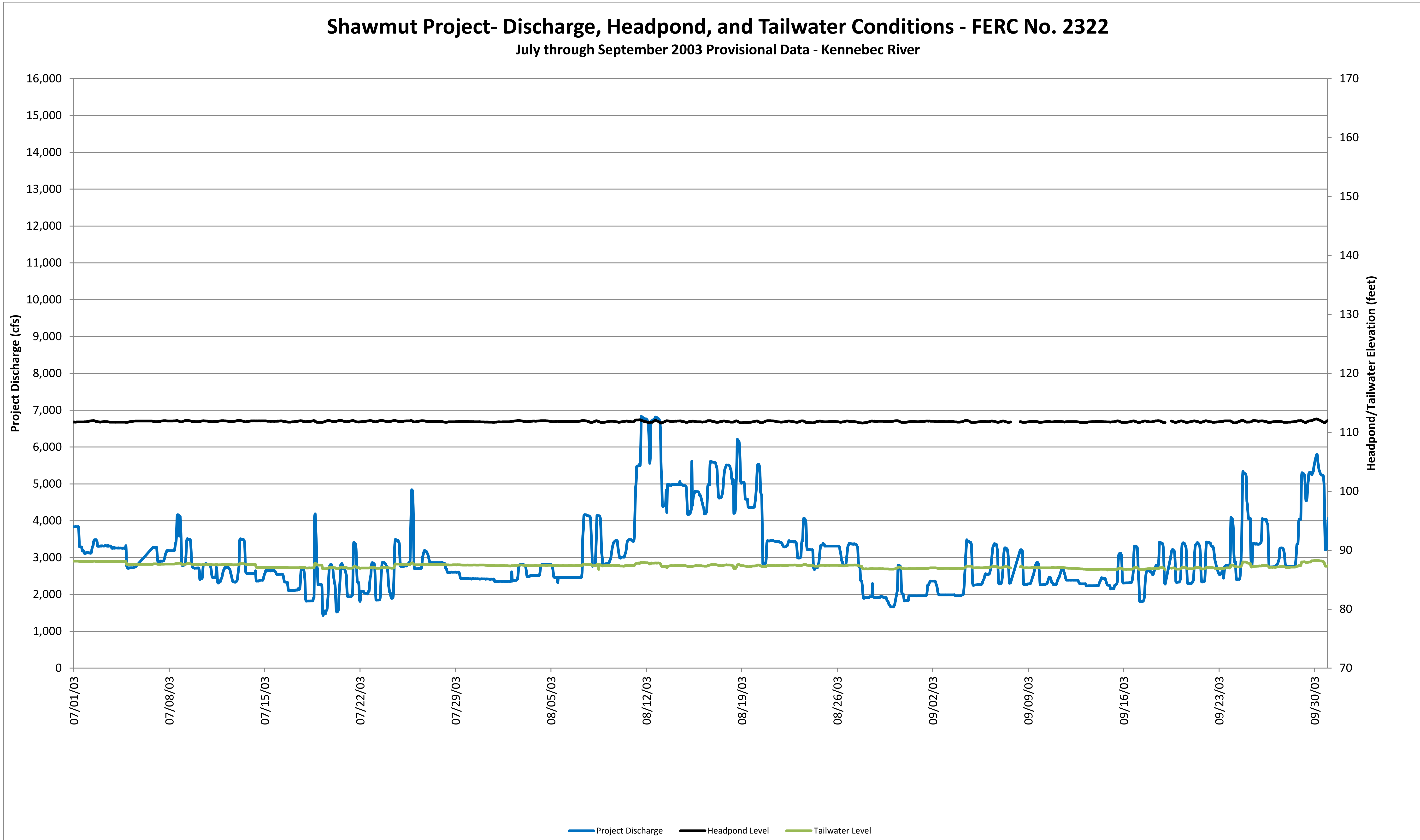
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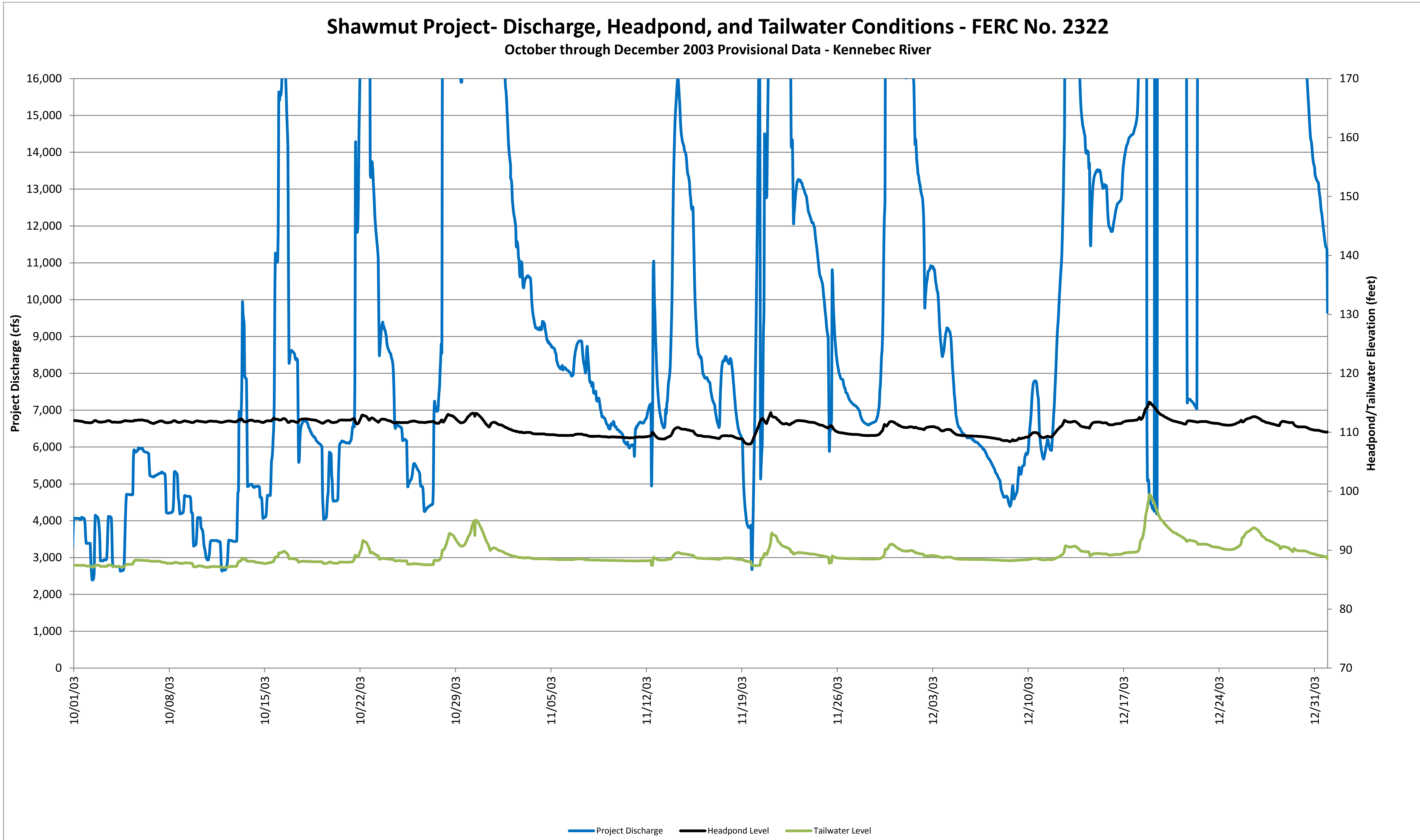

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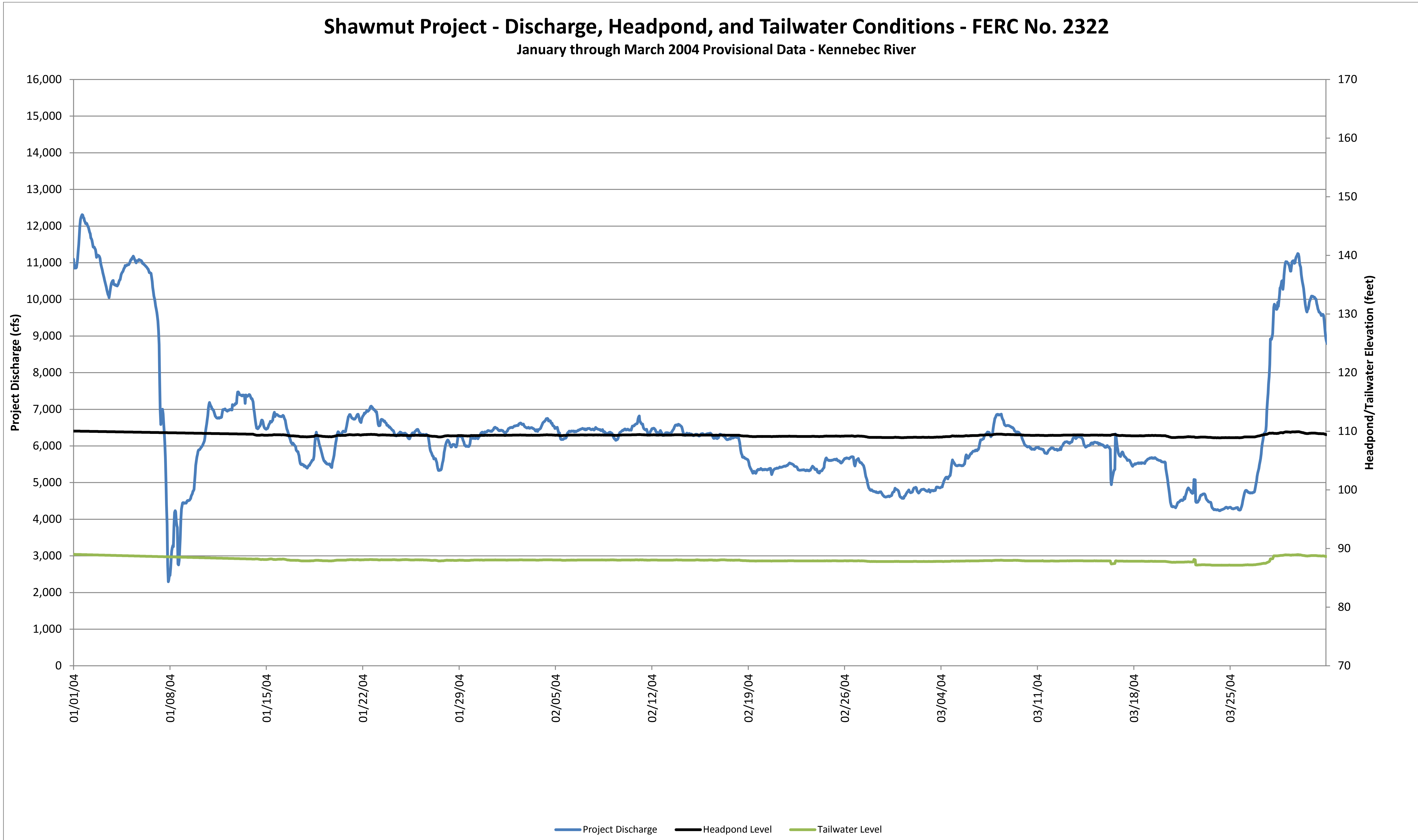
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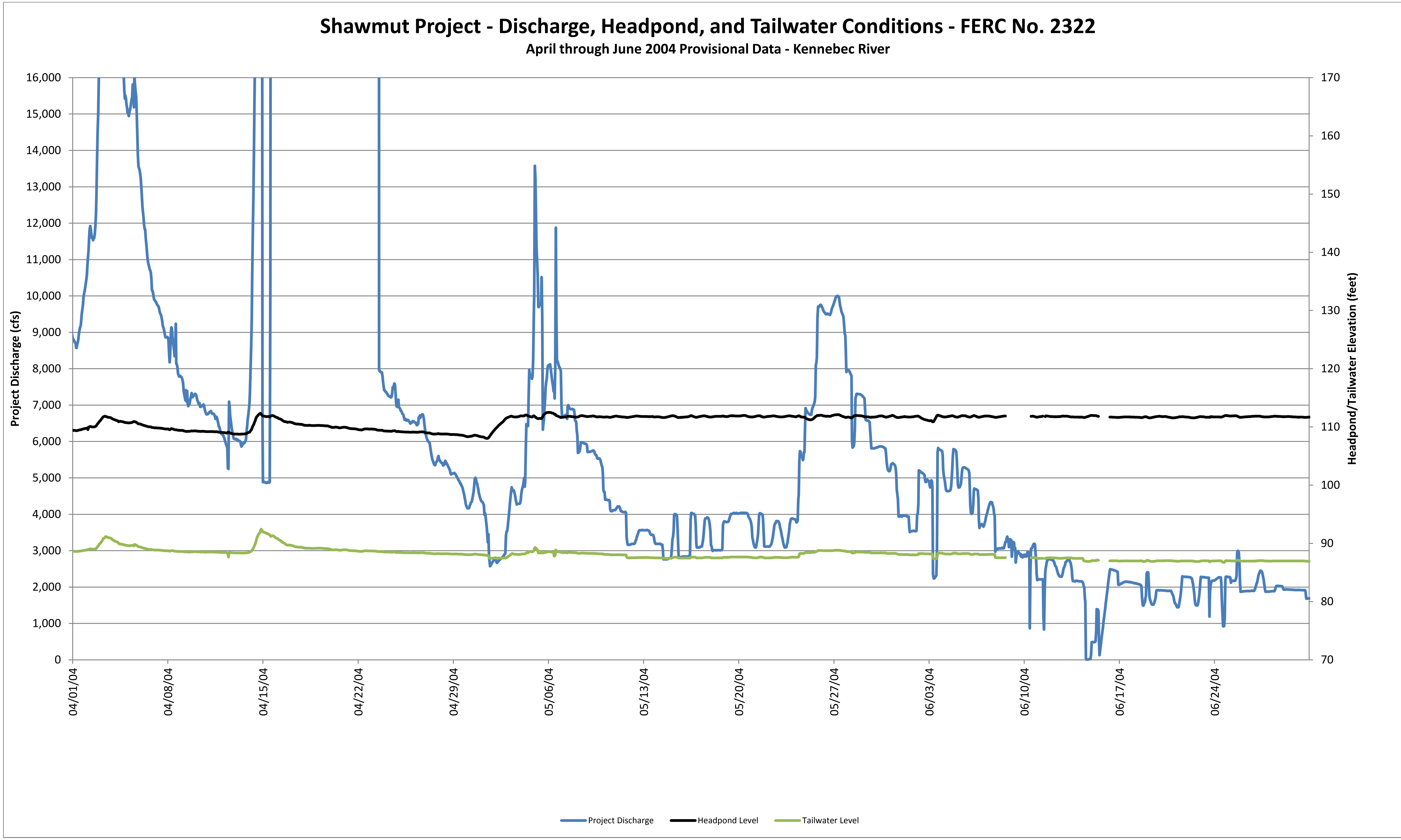

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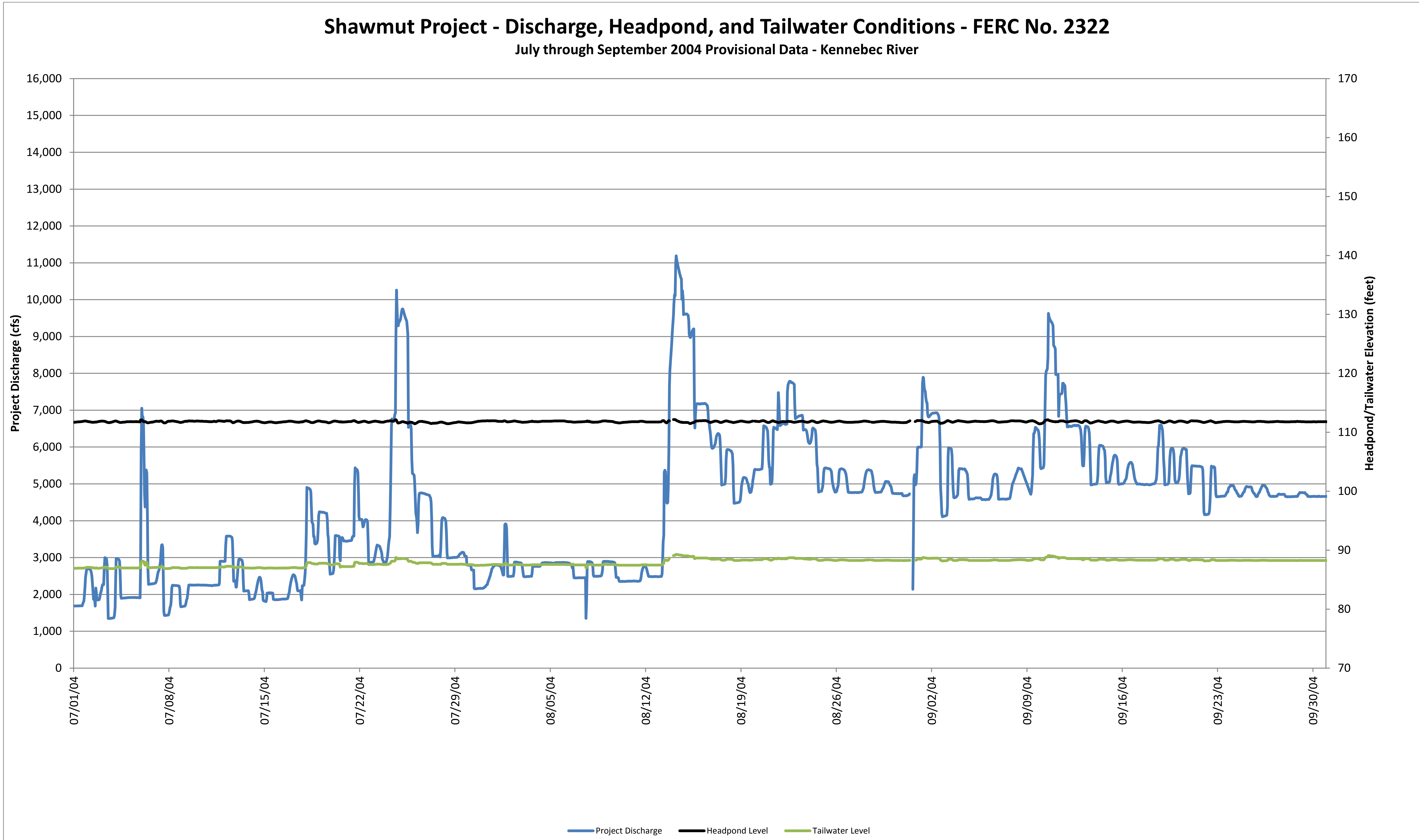

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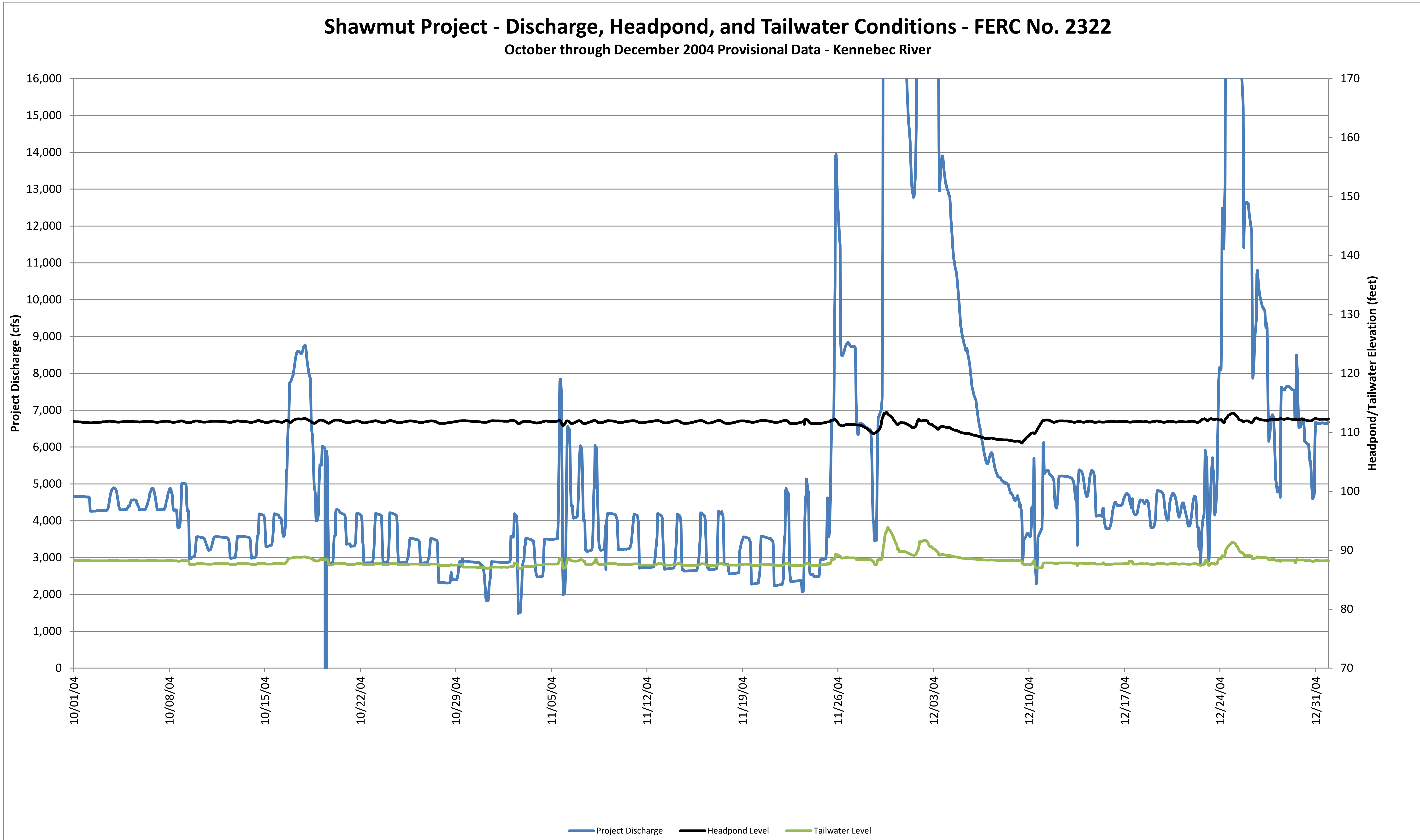
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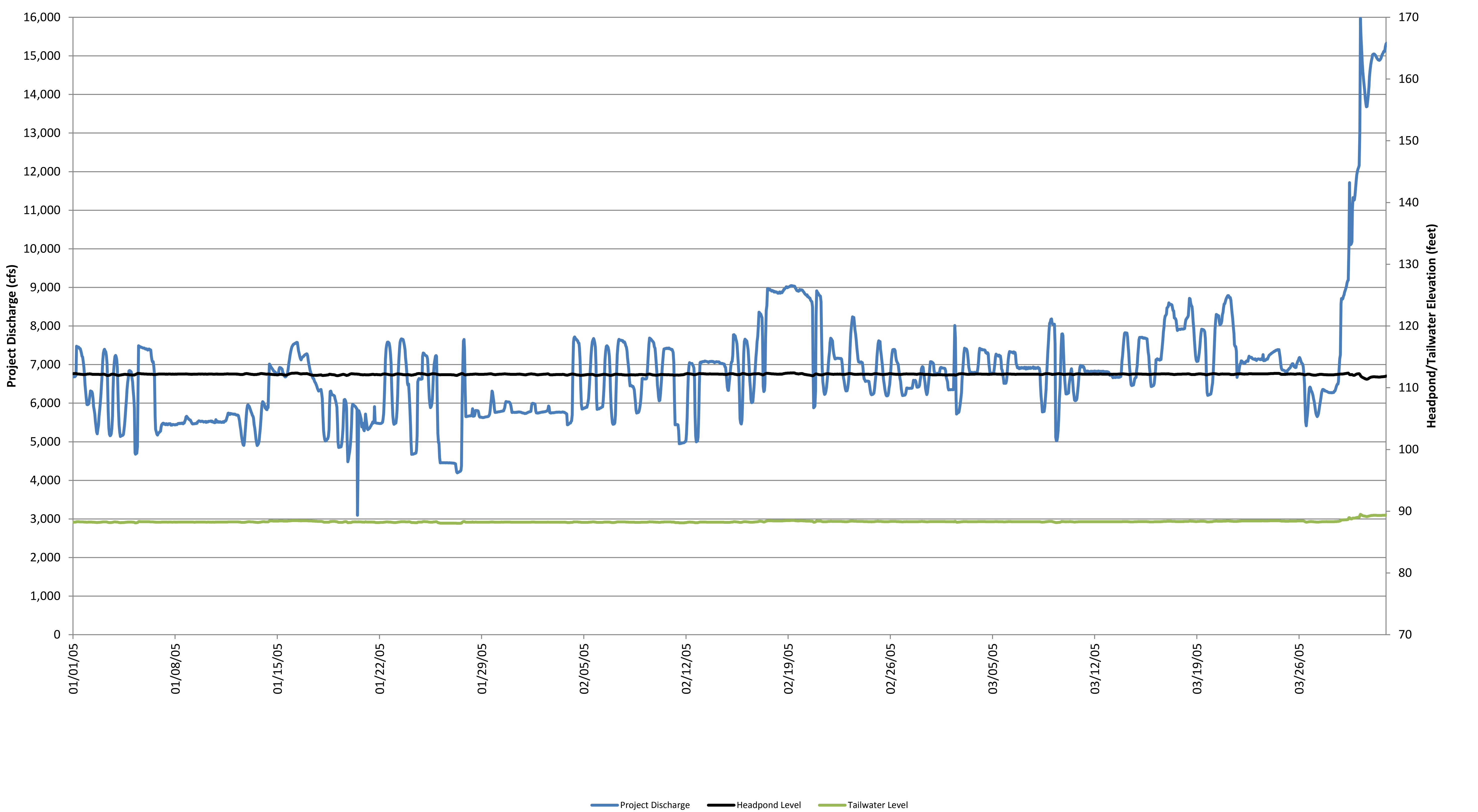
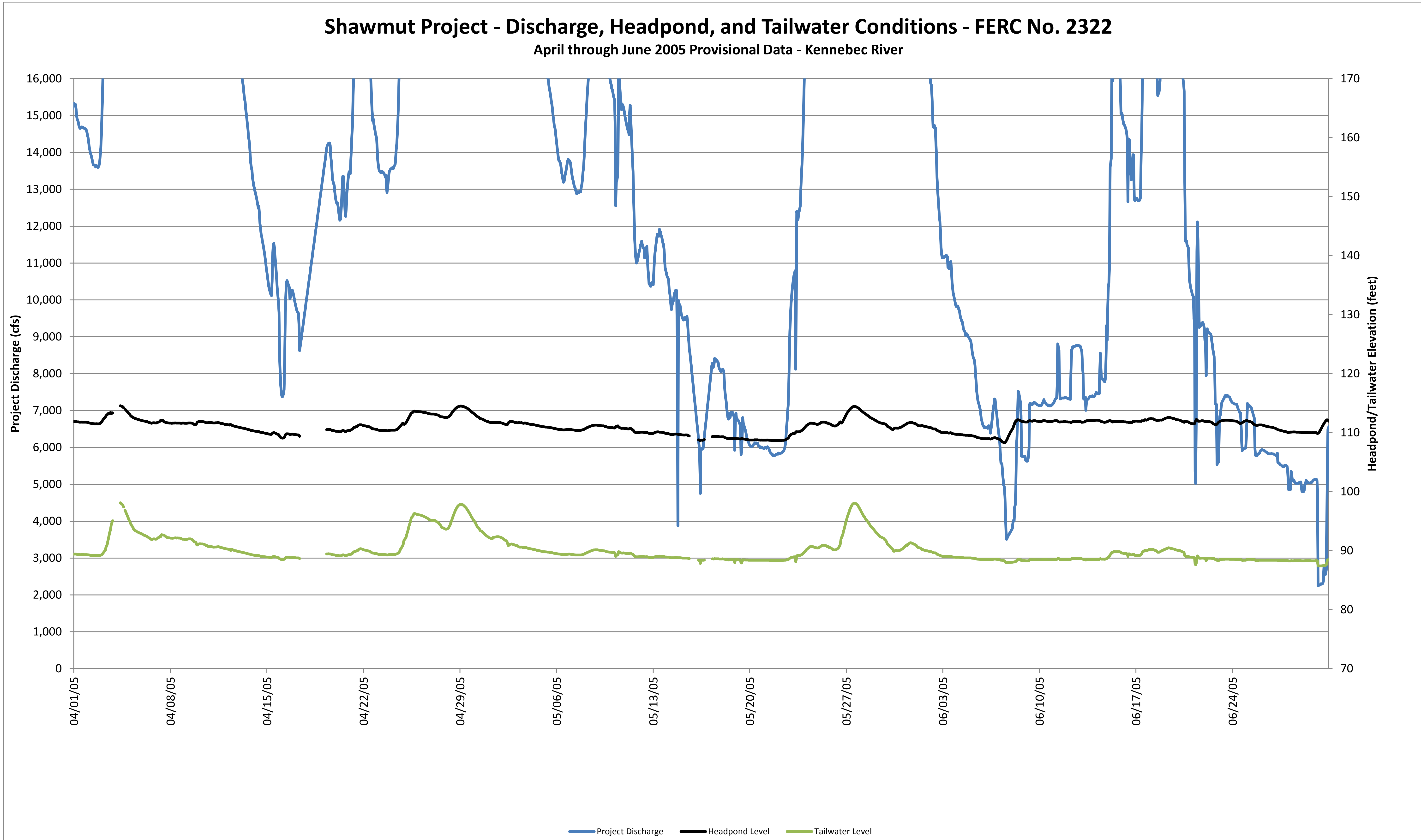
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322

January through March 2005 Provisional Data - Kennebec River

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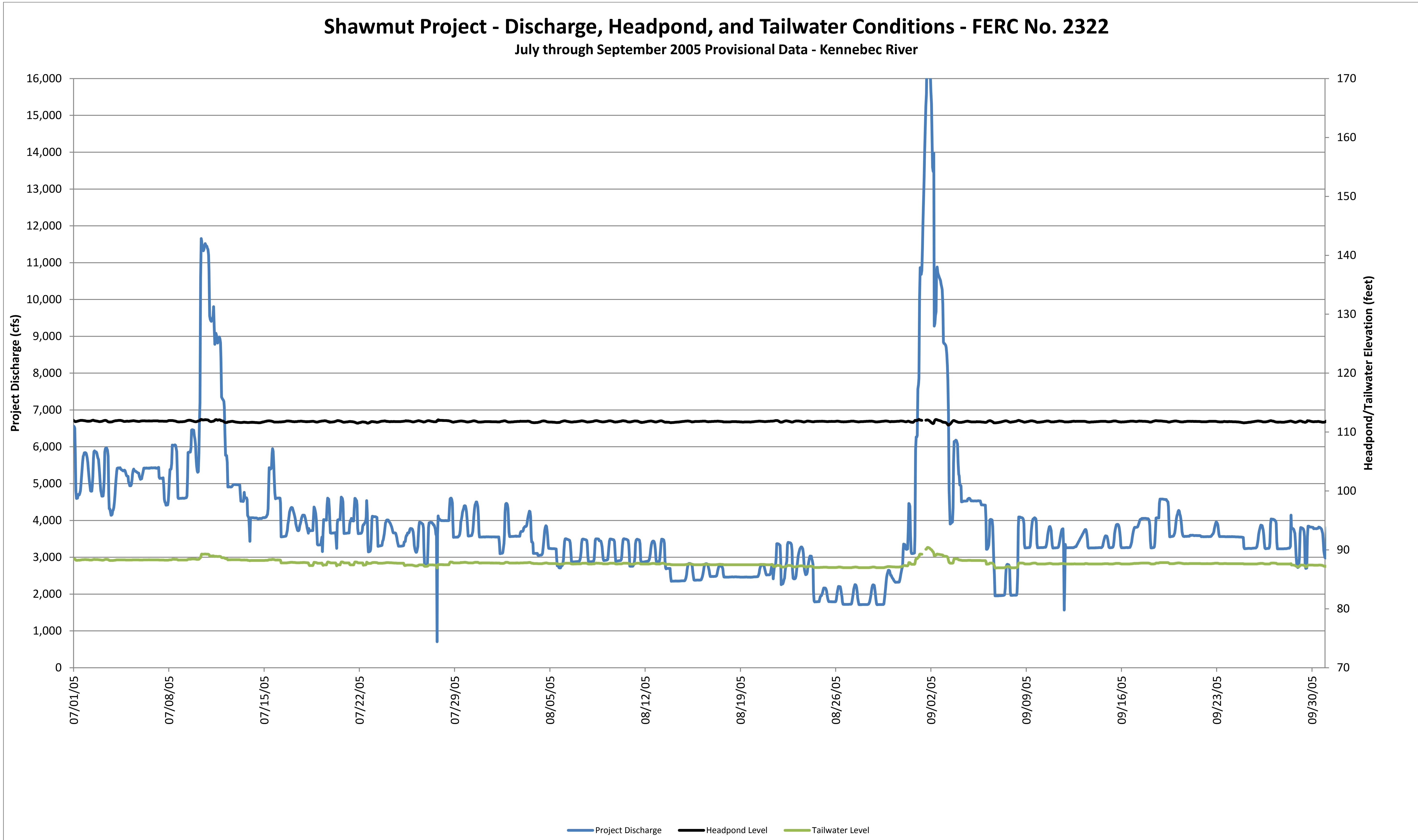
Tailwater Level



Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2005 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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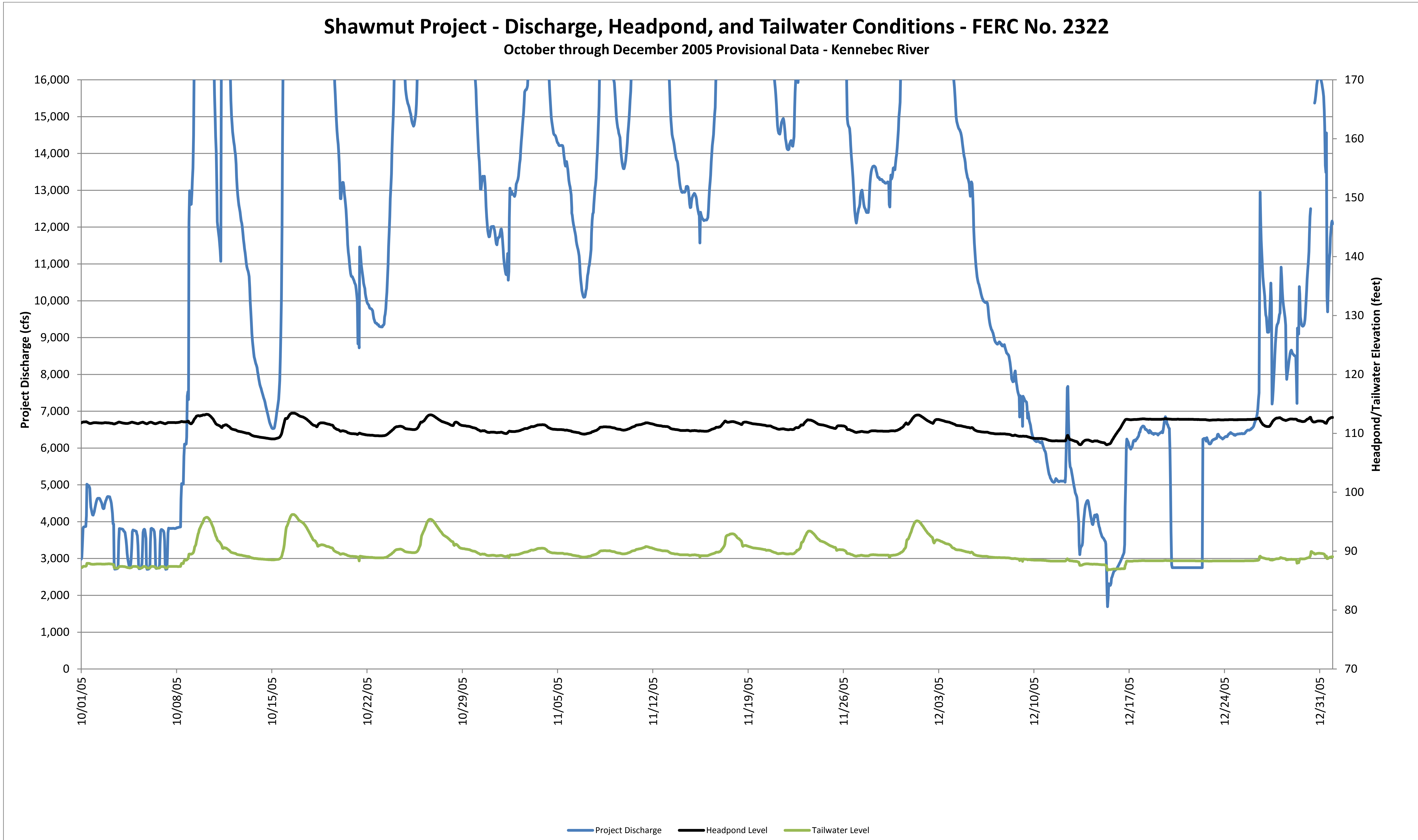
Project Discharge
Headpond Level
Tailwater Level


Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2005 Provisional Data - Kennebec River
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Project Discharge
Headpond Level
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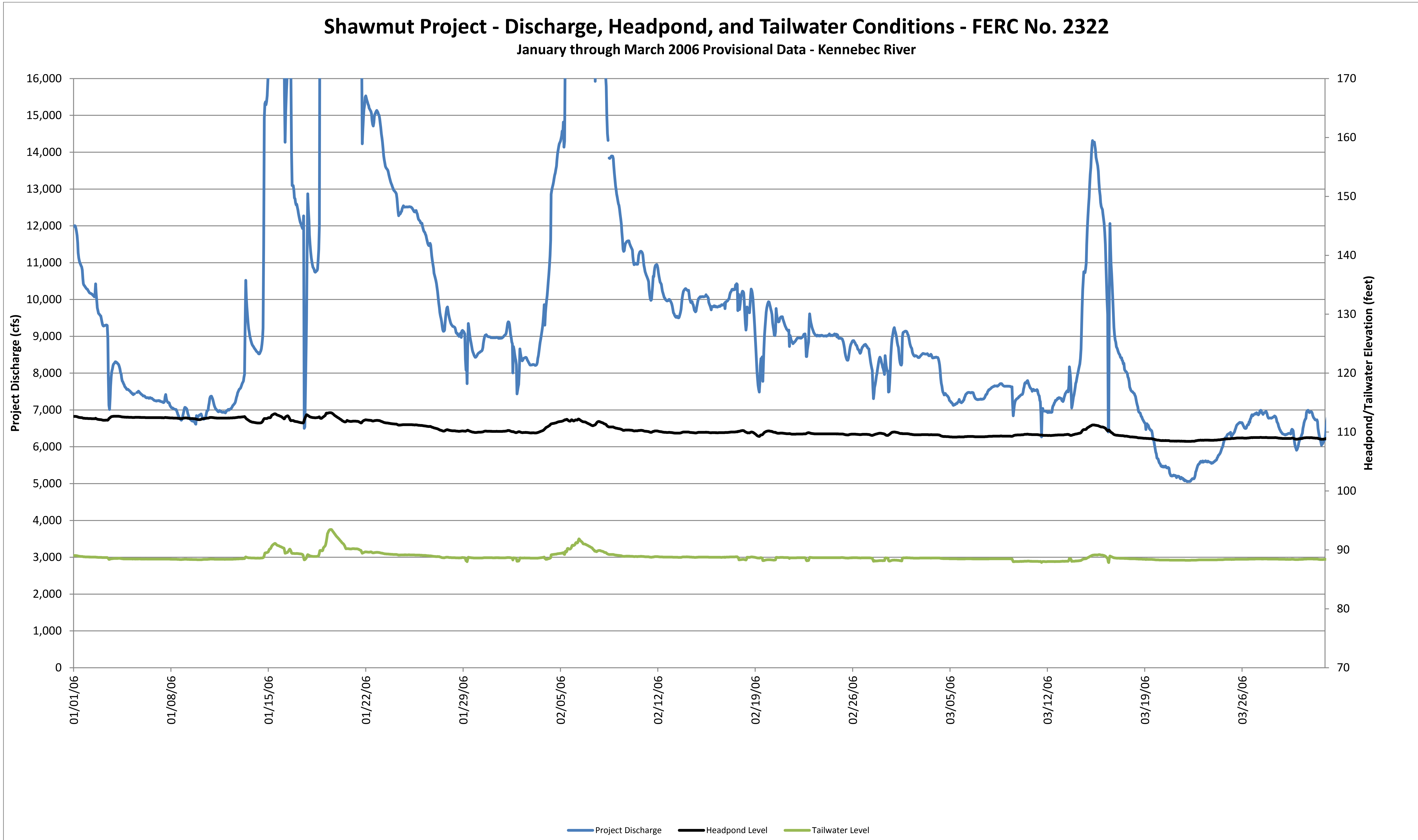

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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Headpond Level
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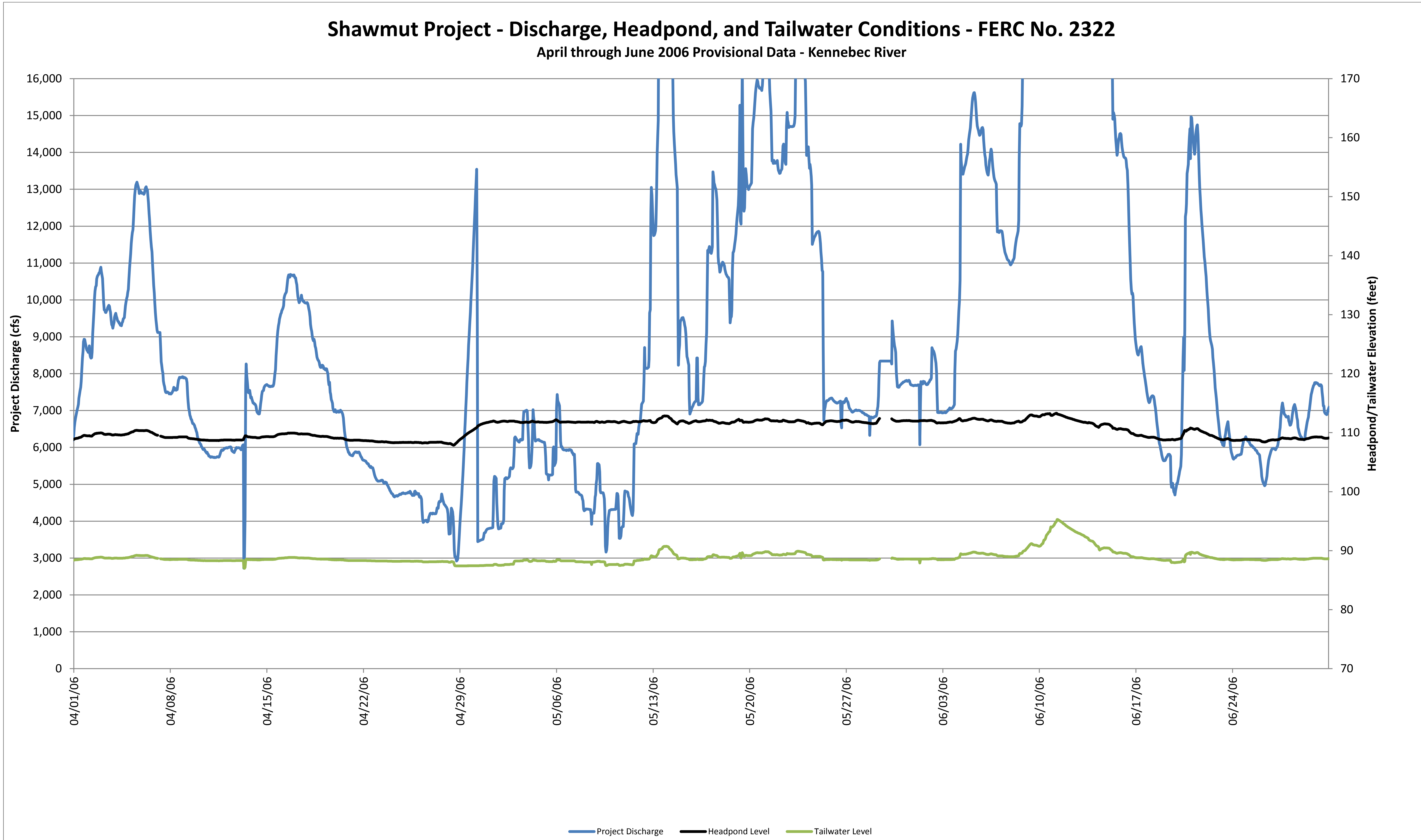

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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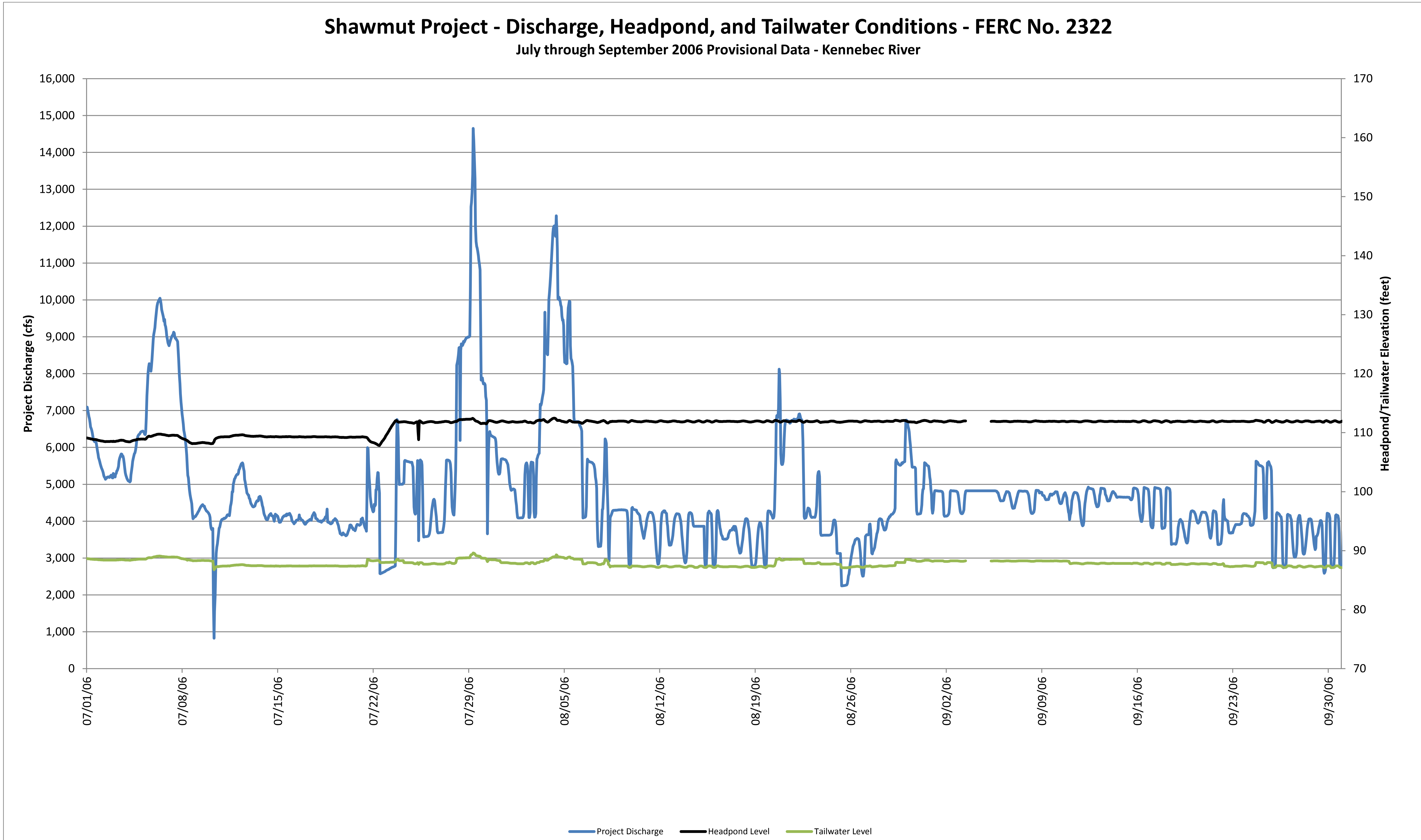
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Project Discharge
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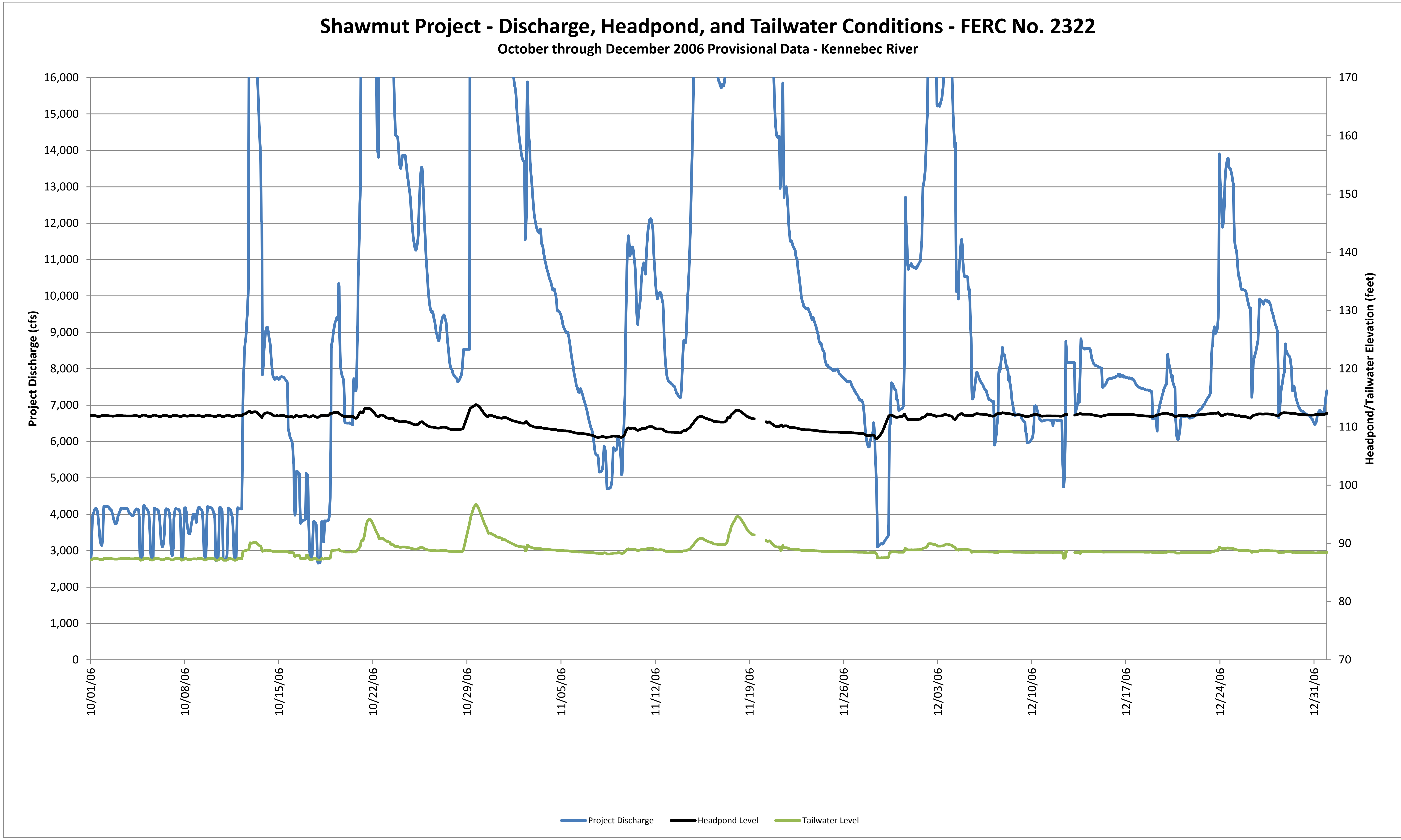
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Project Discharge
Headpond Level
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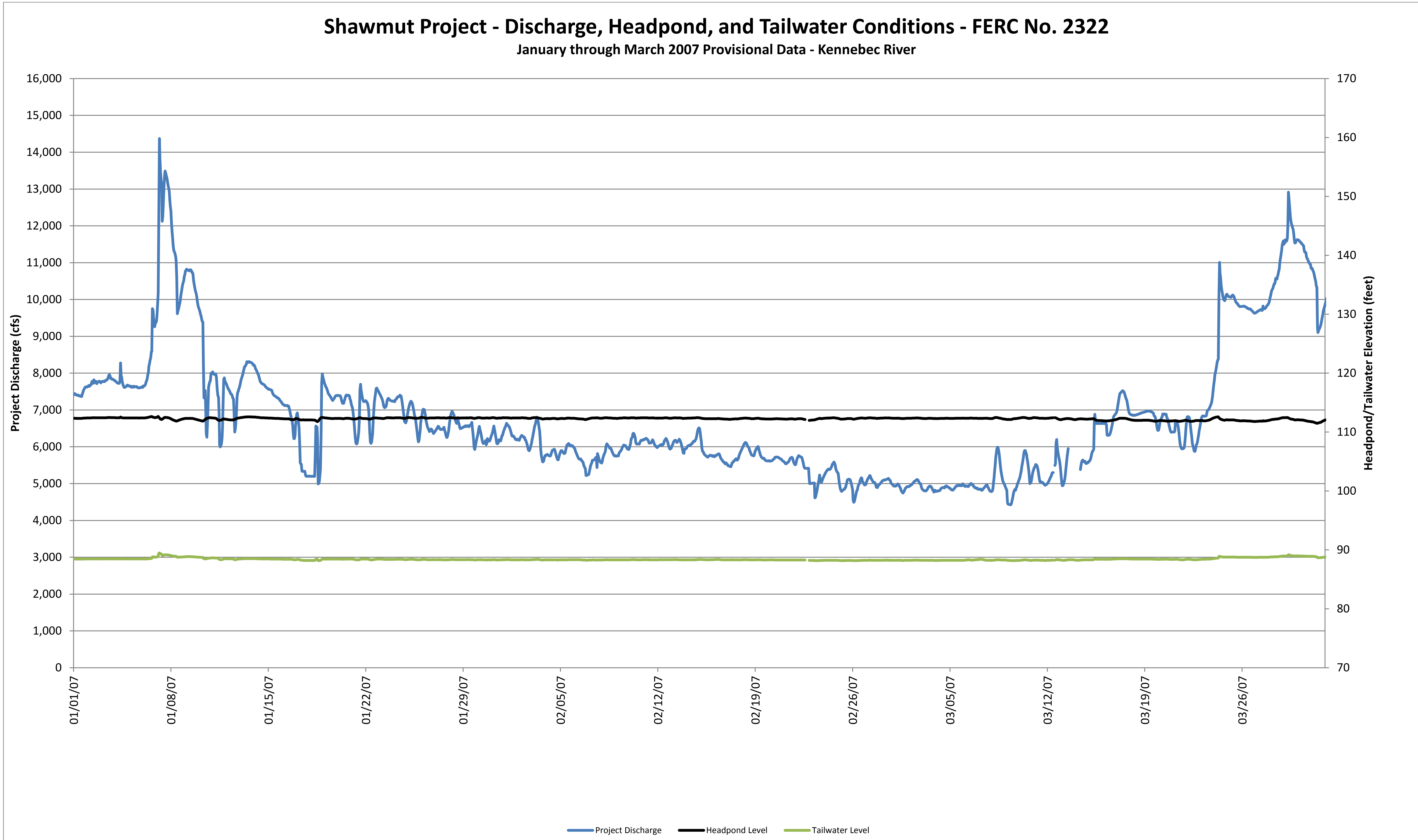
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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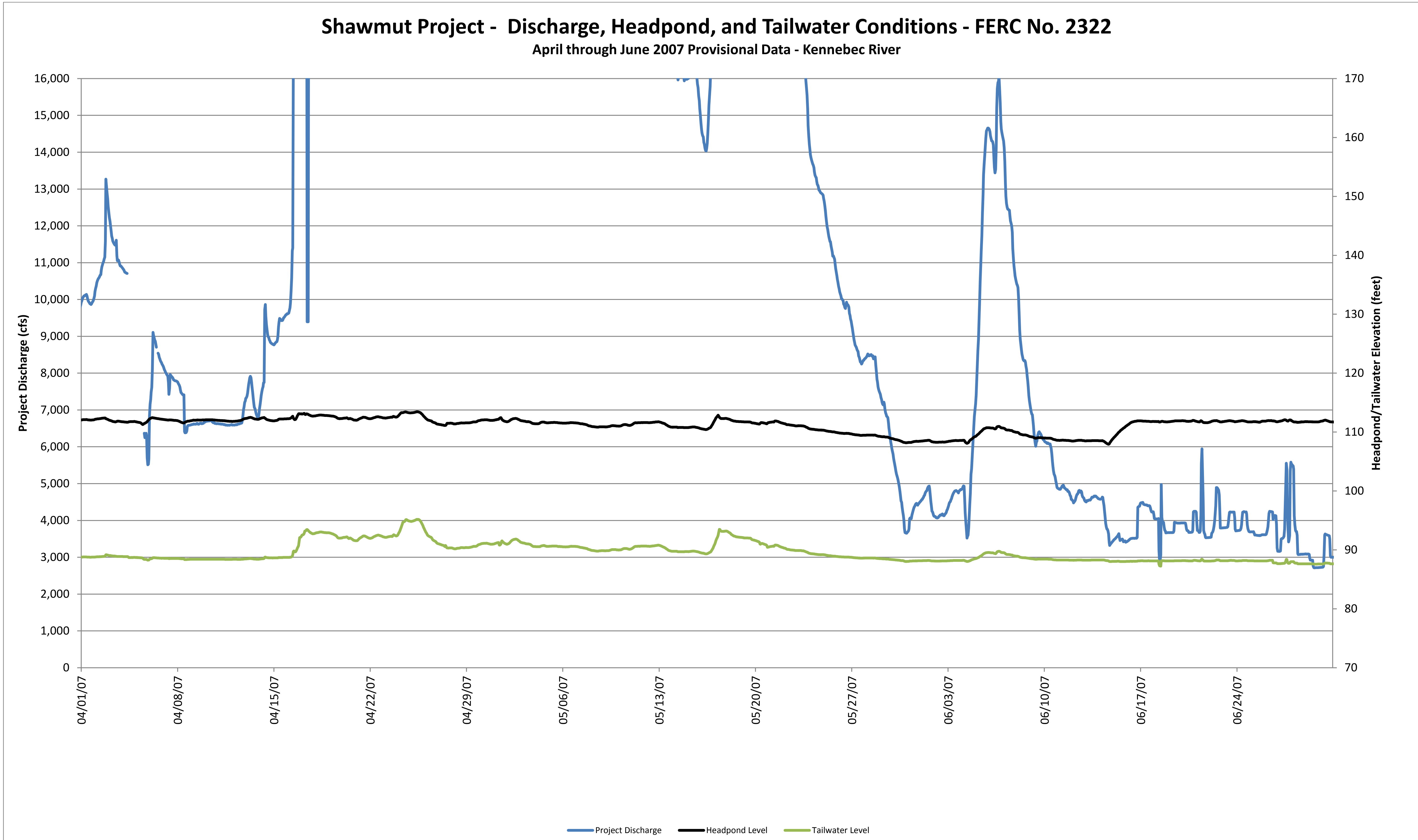

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2007 Provisional Data - Kennebec River
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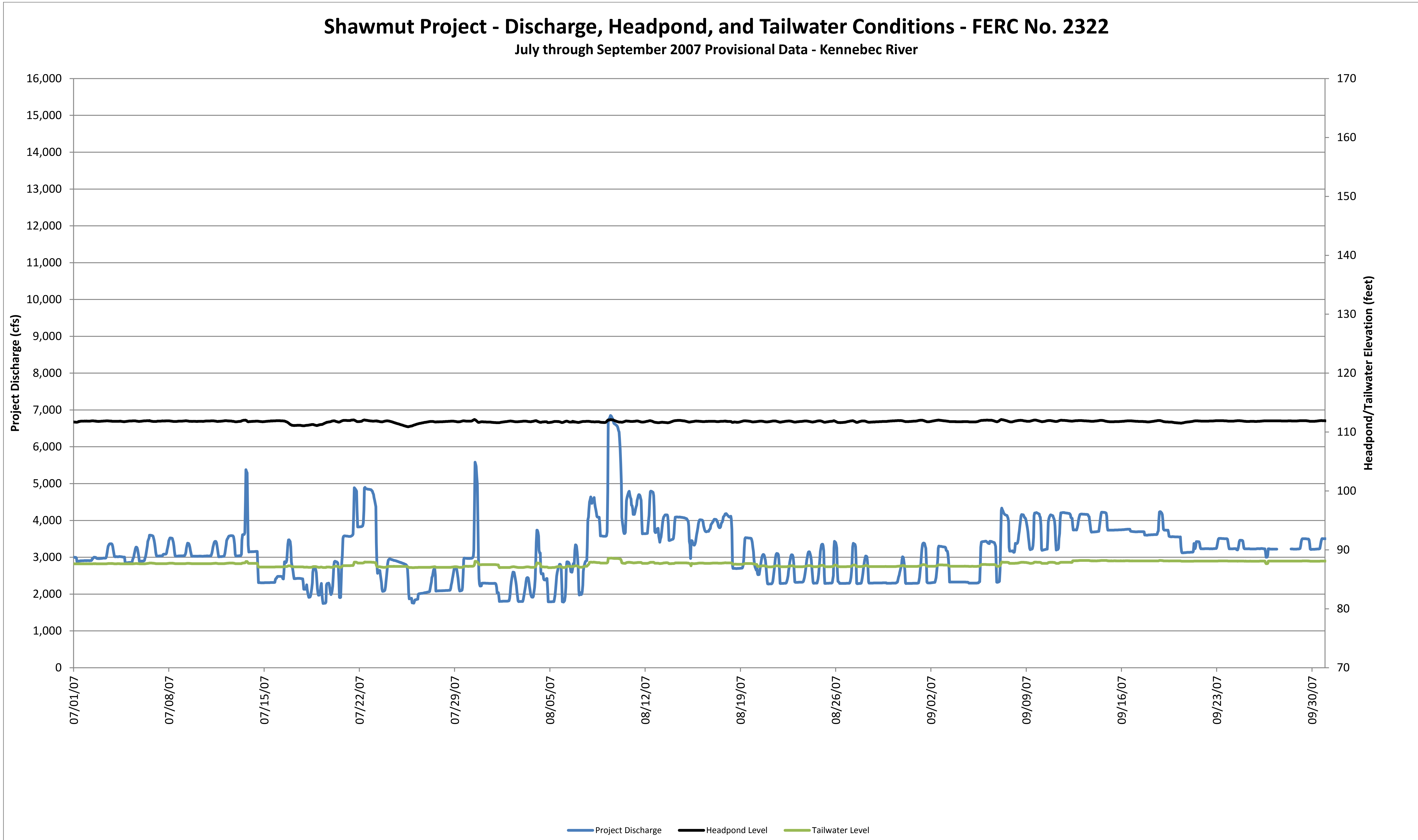

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Project Discharge
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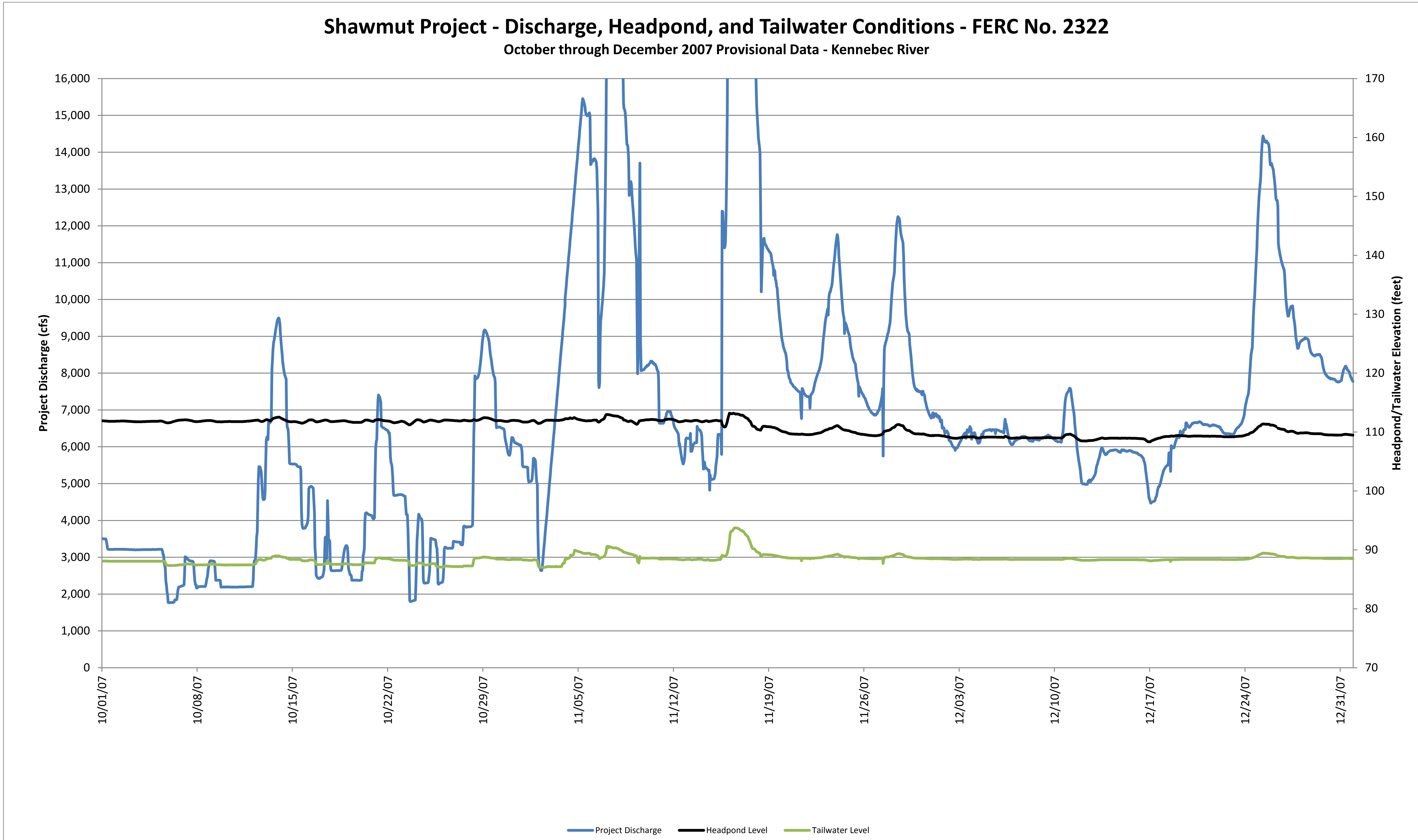

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2007 Provisional Data - Kennebec River
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Project Discharge
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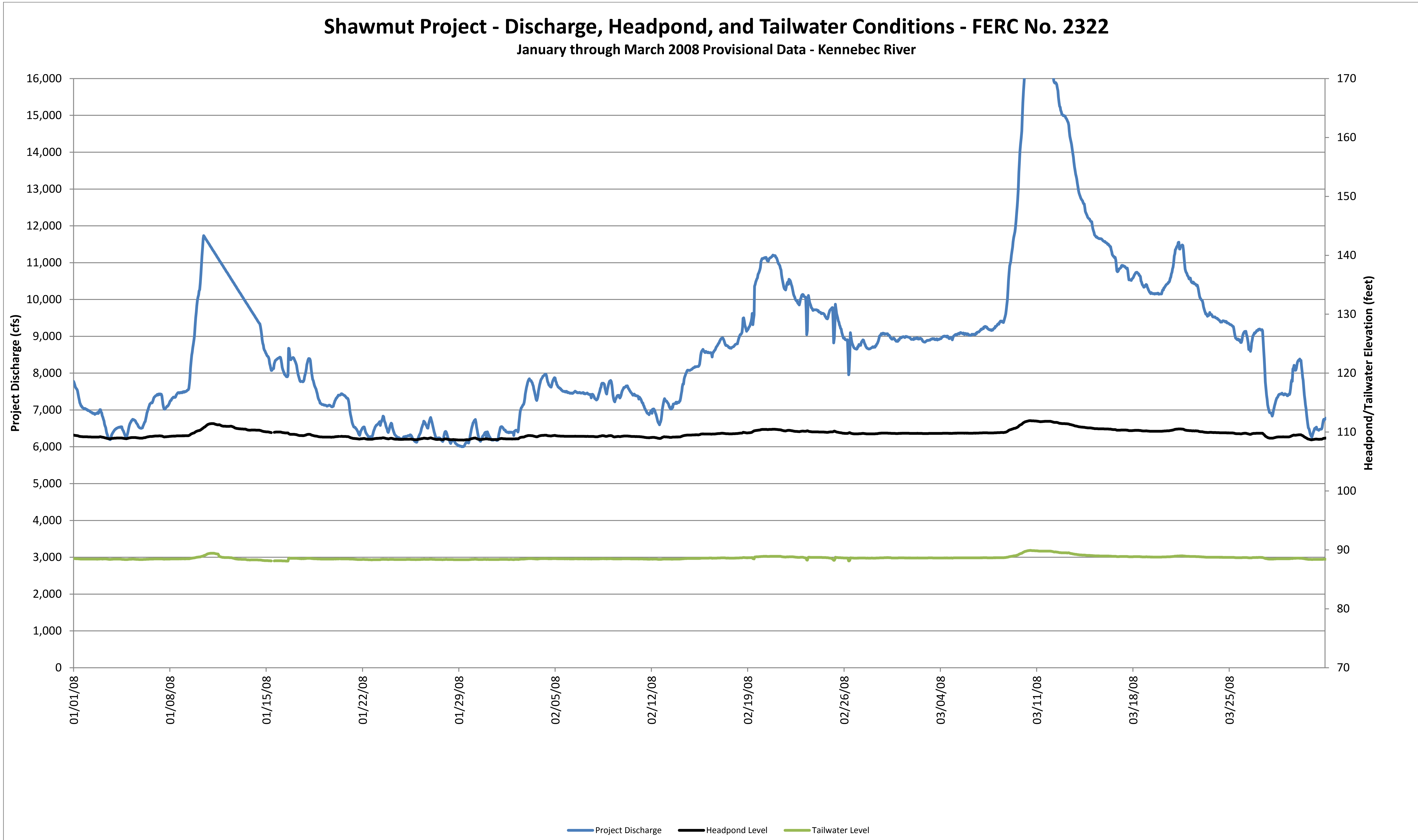

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2008 Provisional Data - Kennebec River
Project Discharge (cfs)
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Project Discharge
Headpond Level
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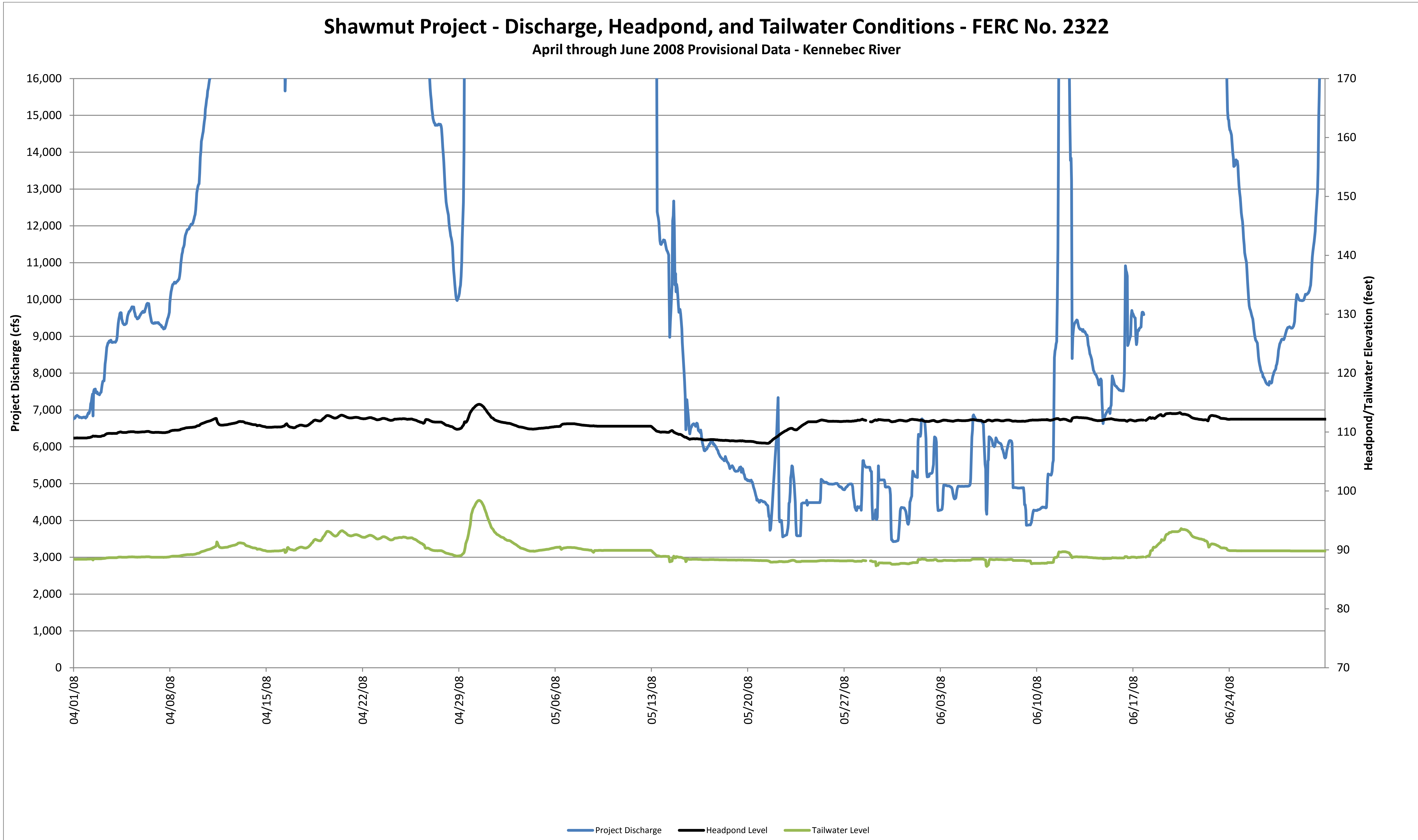

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2008 Provisional Data - Kennebec River
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Project Discharge
Headpond Level
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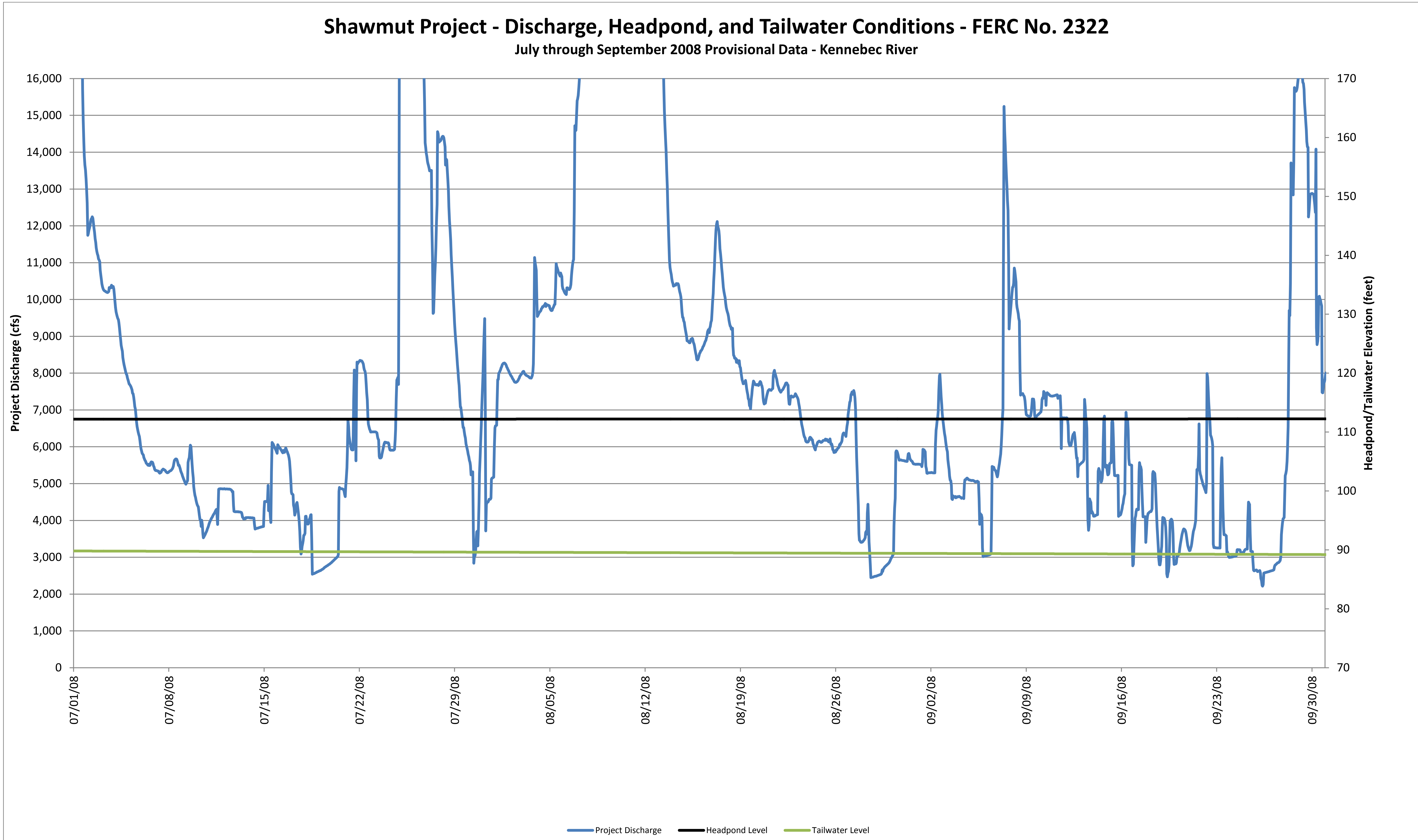

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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Project Discharge
Headpond Level
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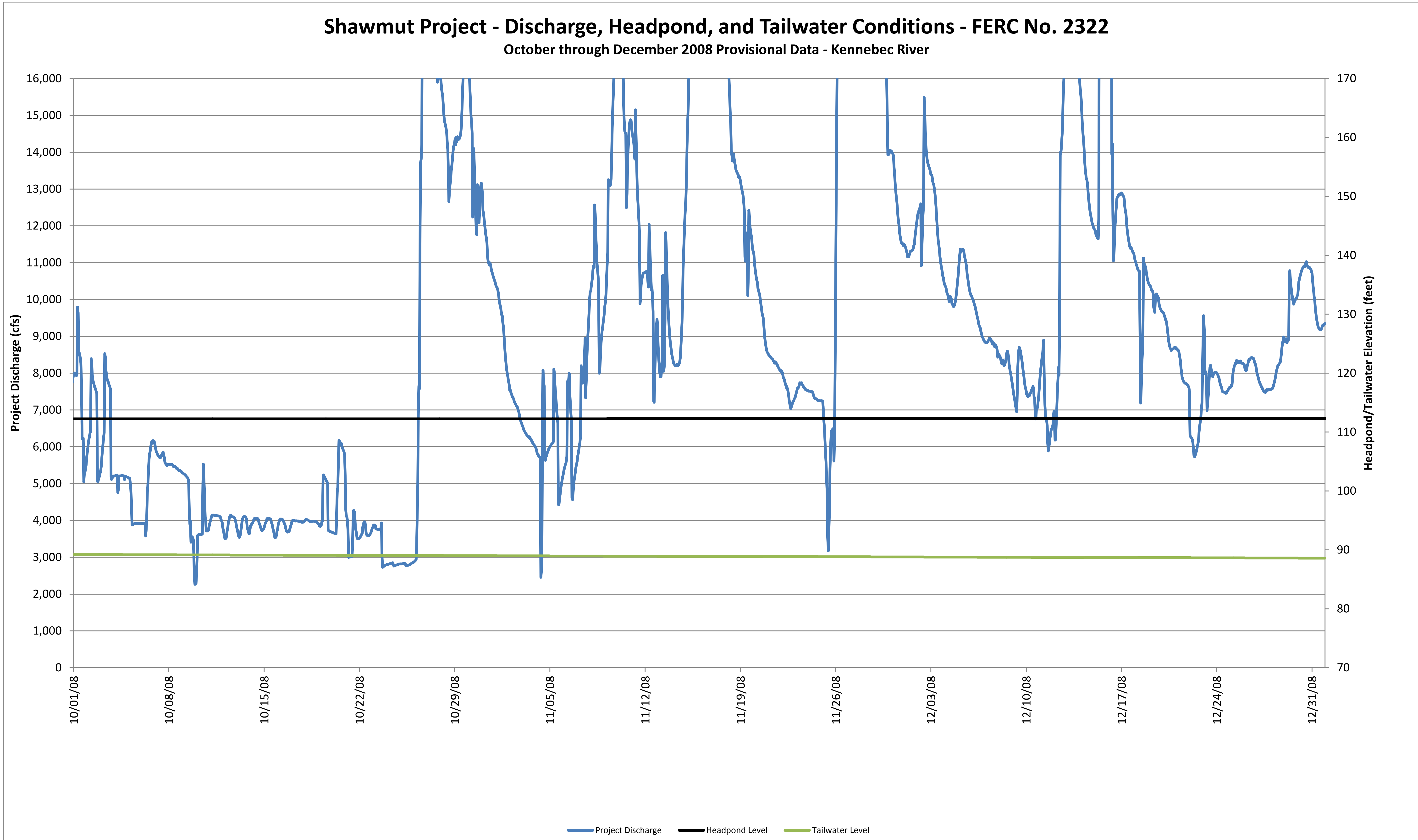

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2008 Provisional Data - Kennebec River
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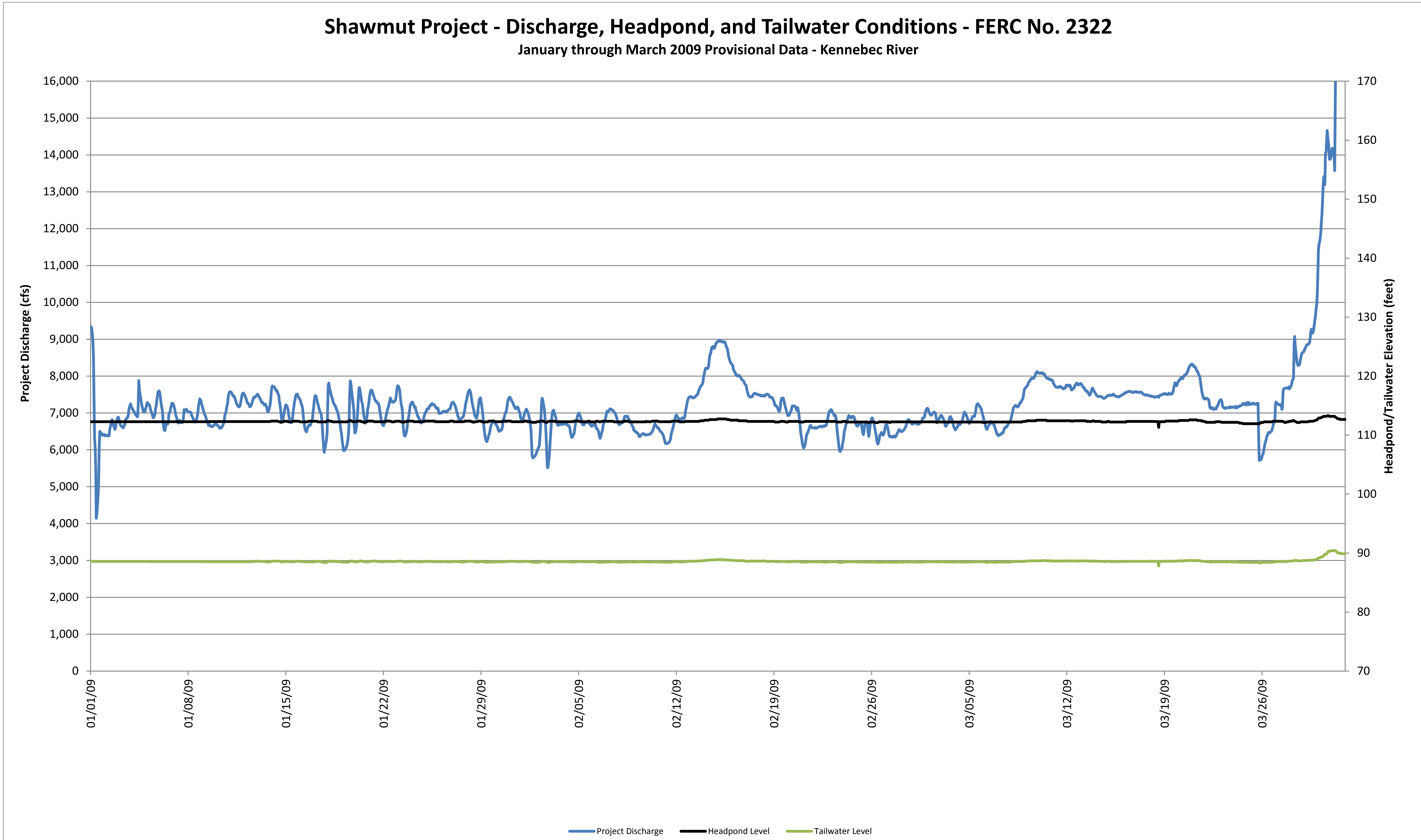
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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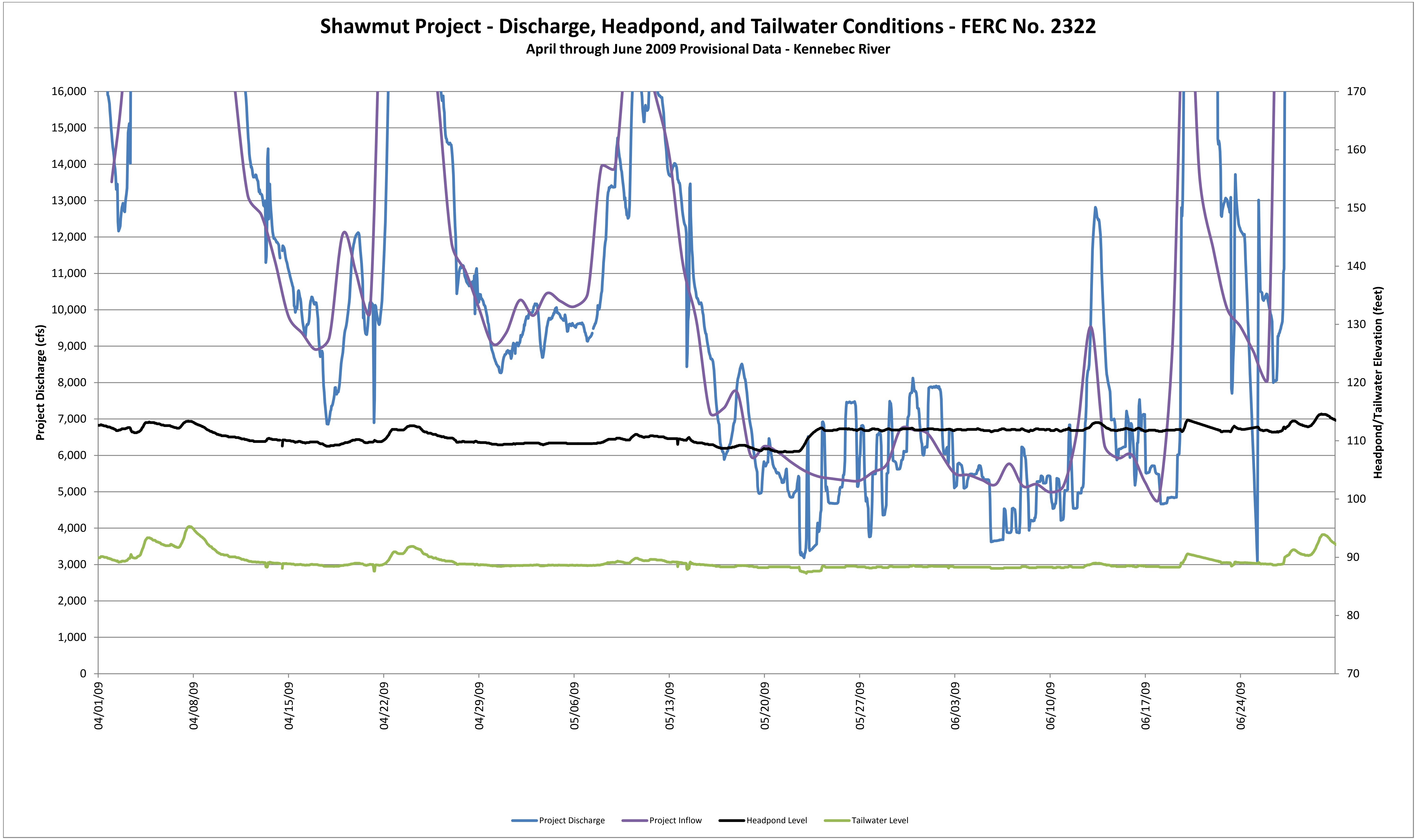
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
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Project Discharge
Project Inflow
Headpond Level
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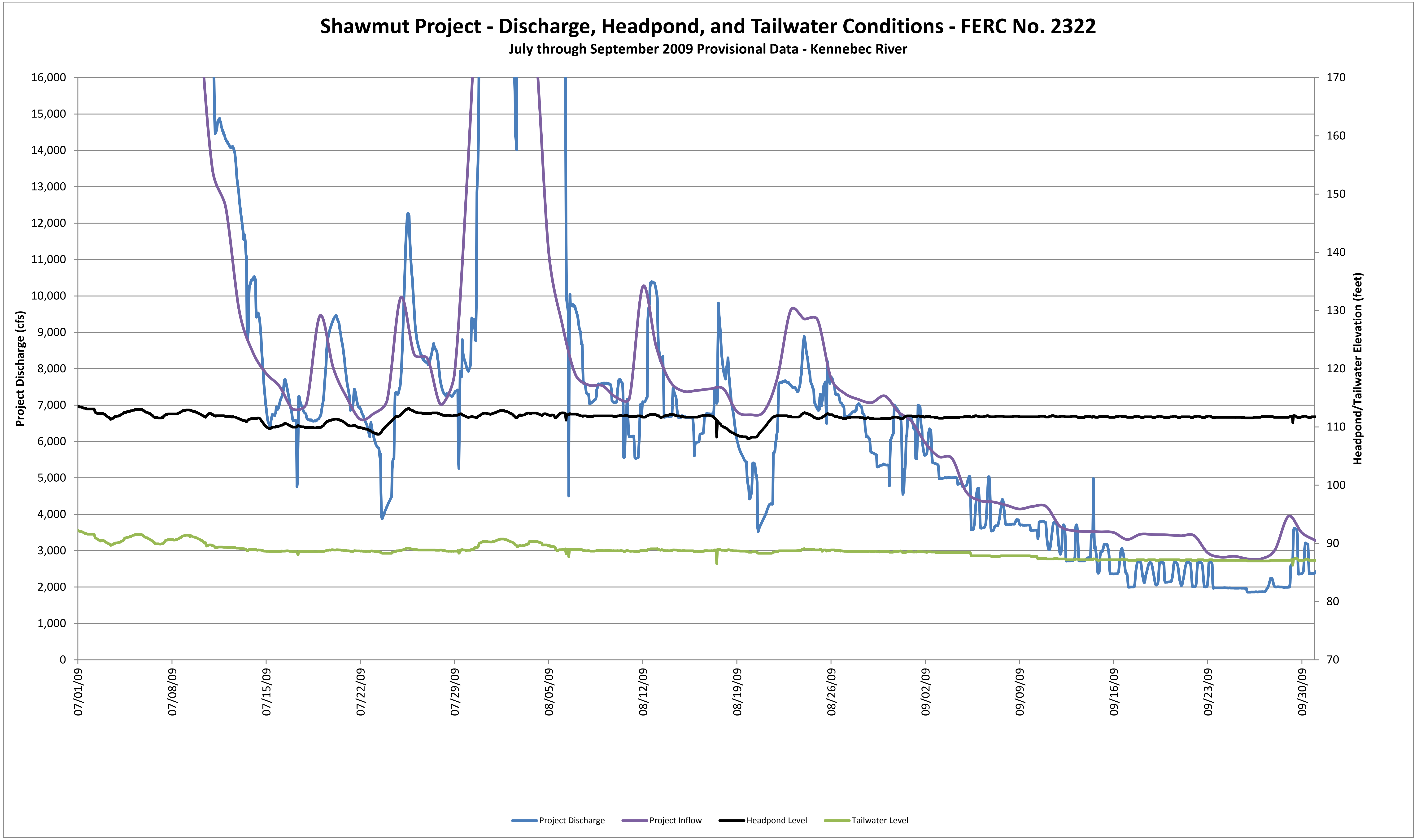
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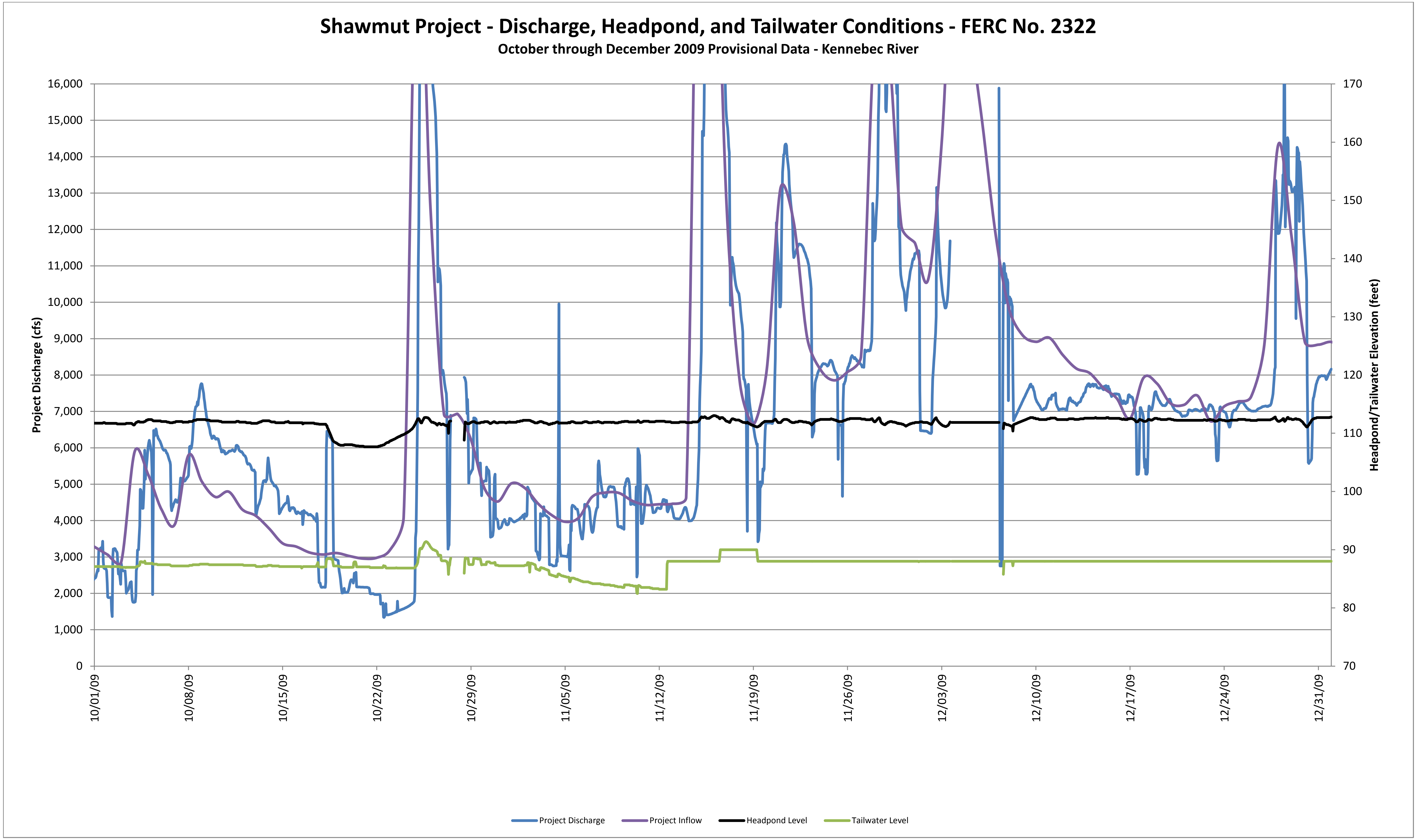

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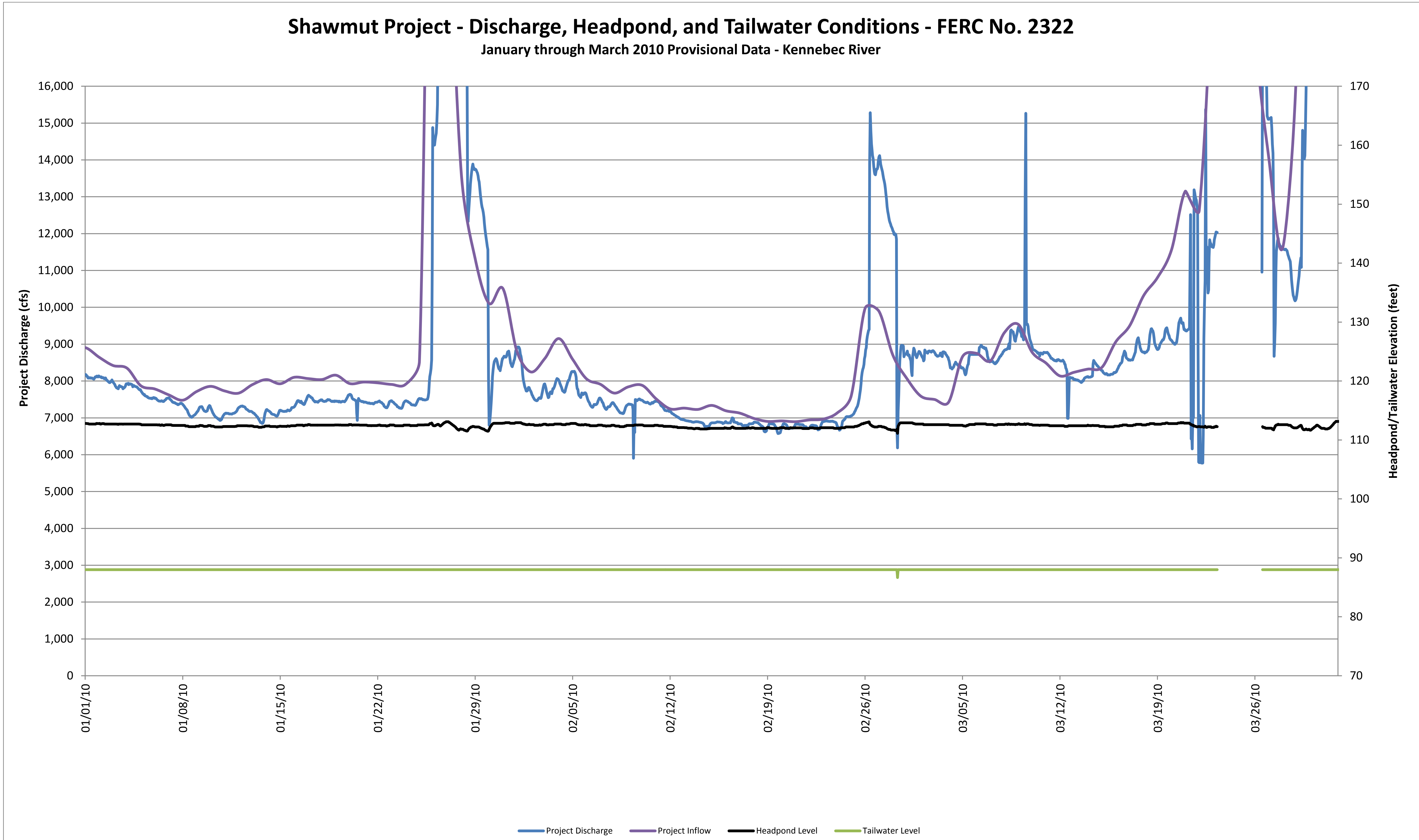

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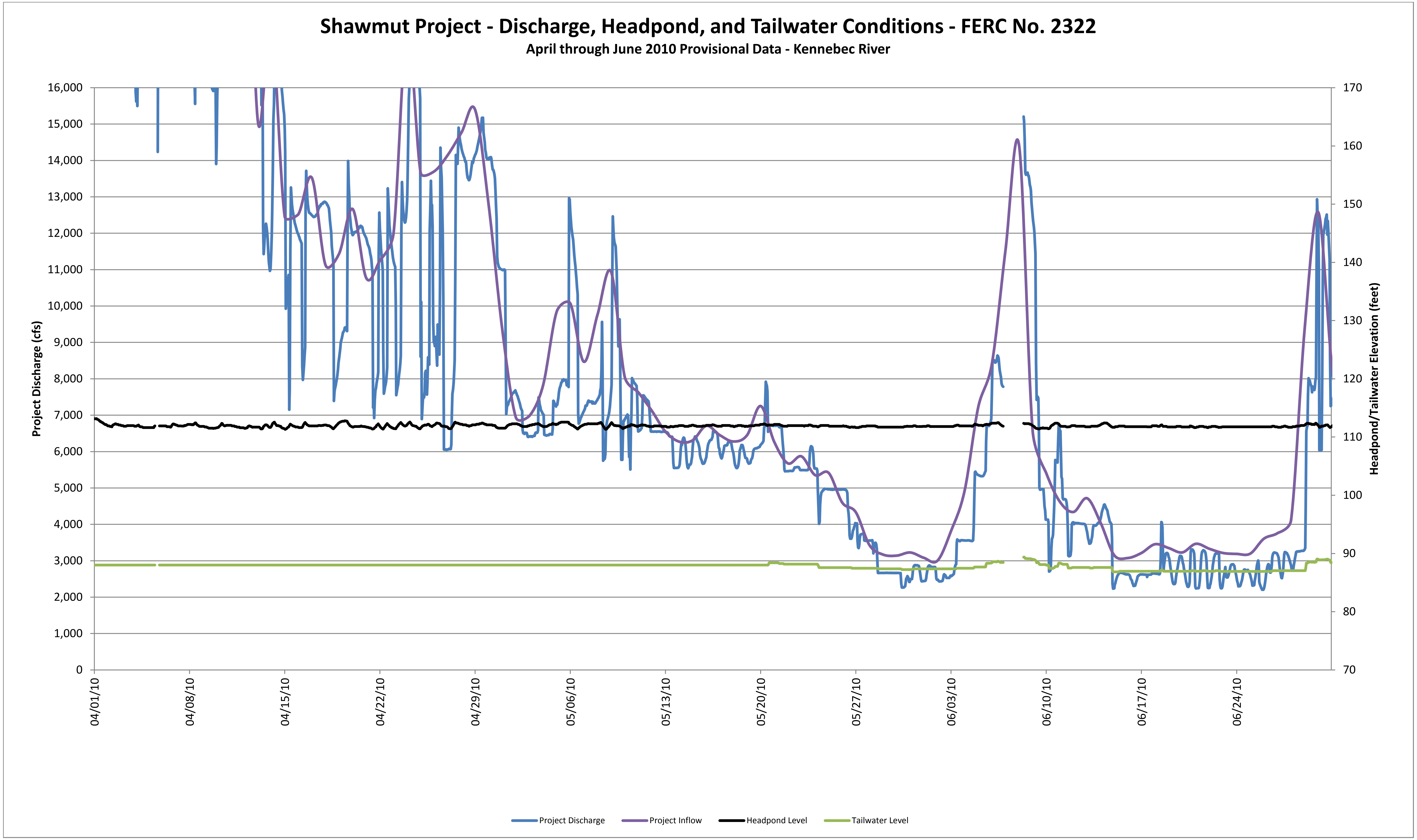

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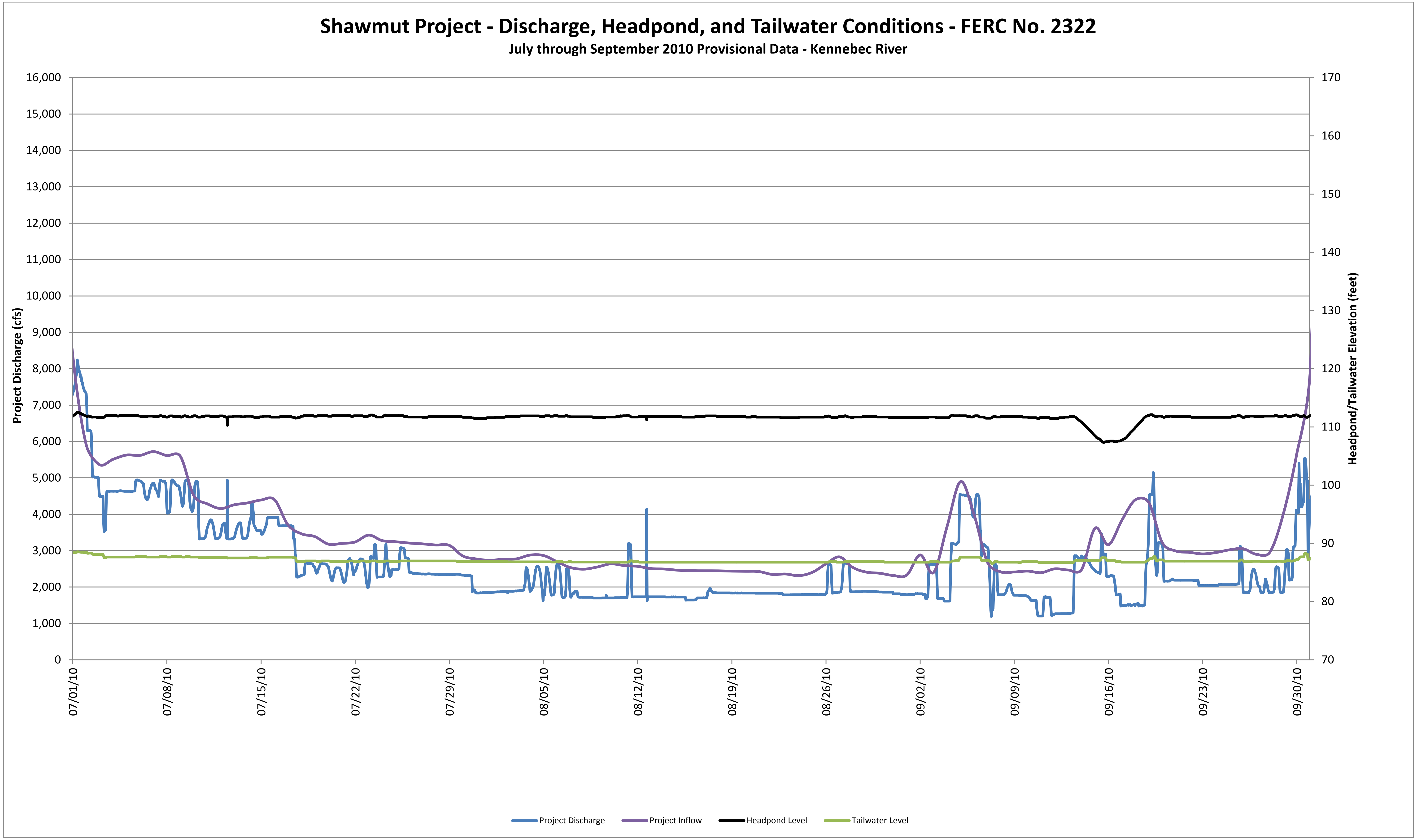

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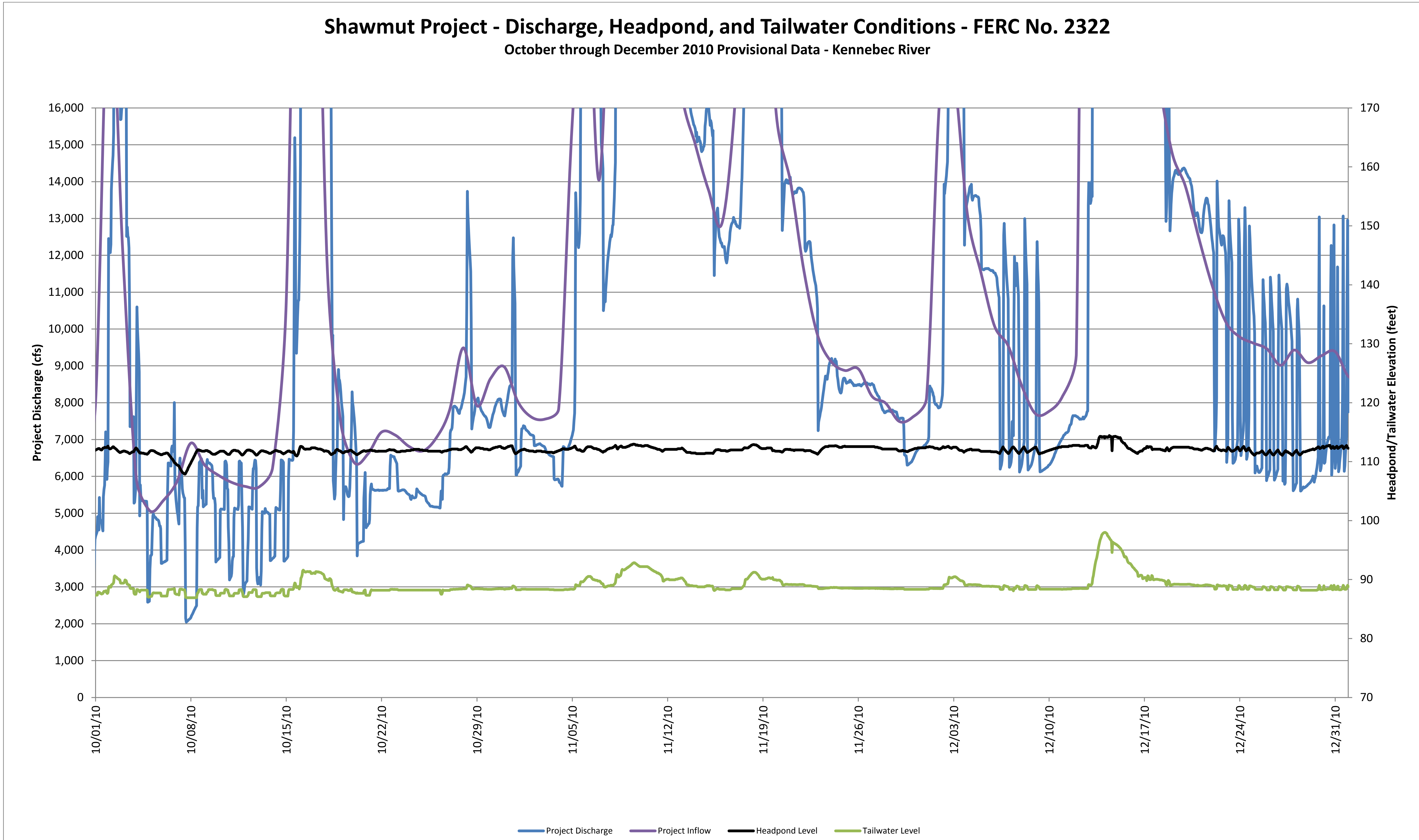
Project Discharge
Project Inflow
Headpond Level
Tailwater Level



Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2010 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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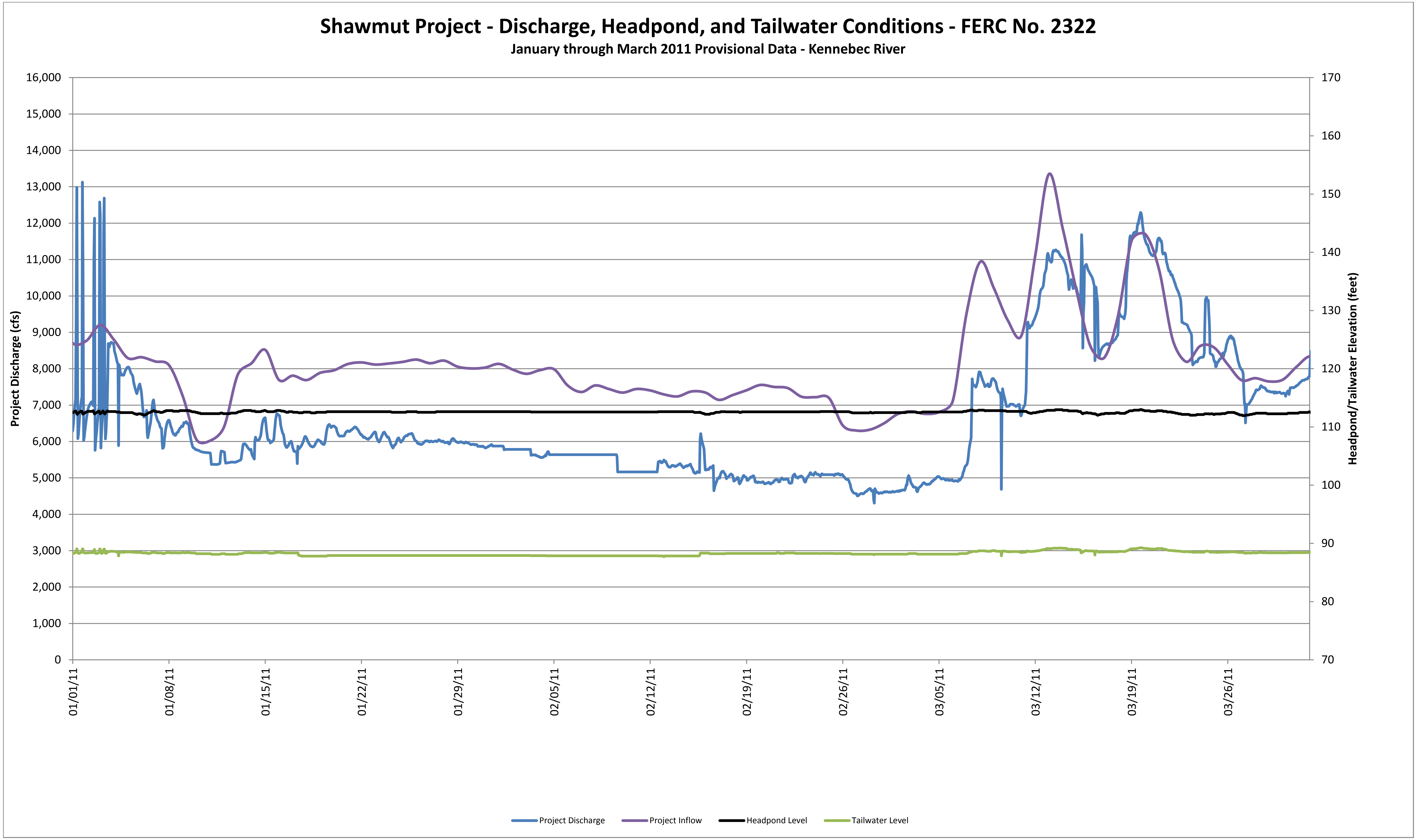

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2011 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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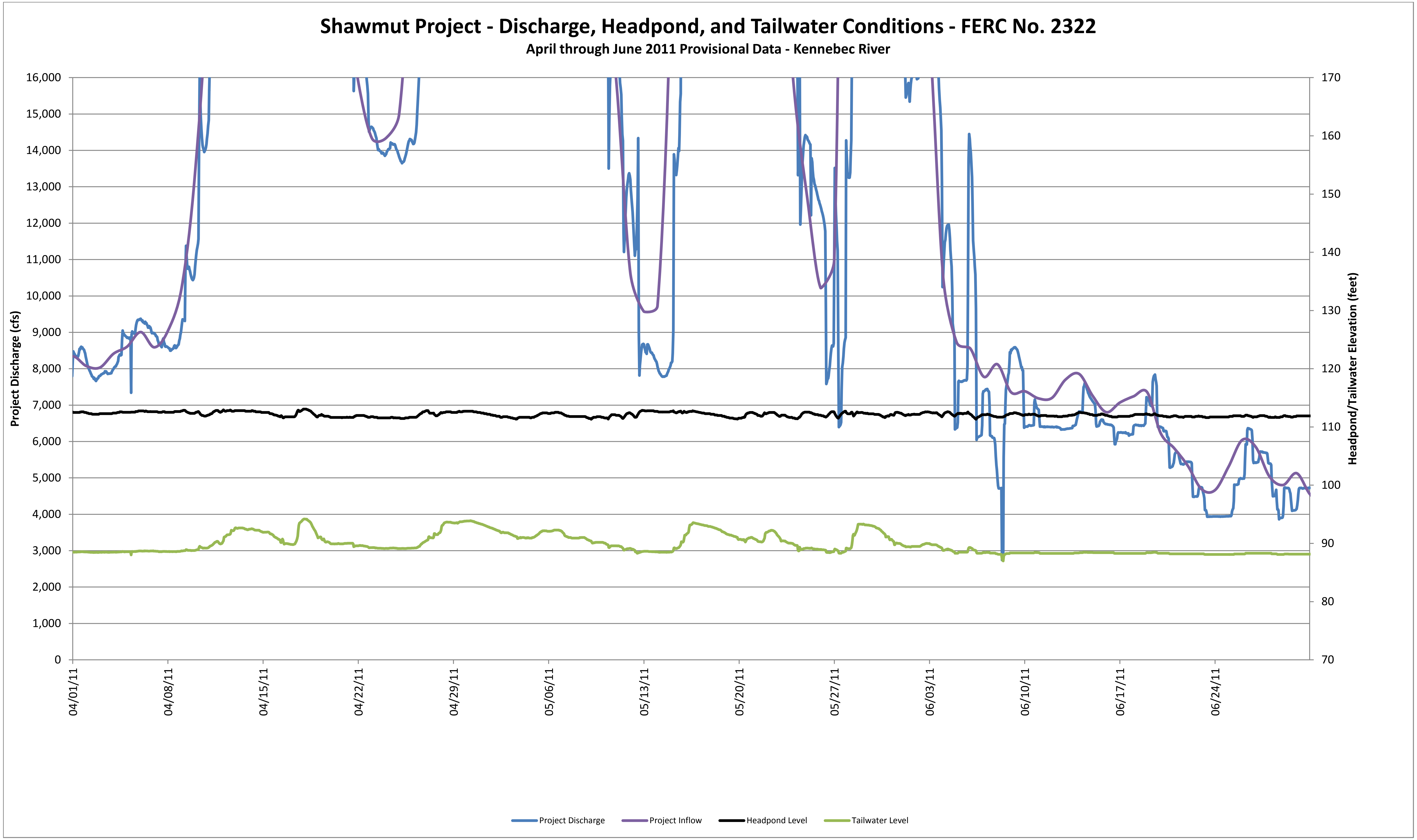

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2011 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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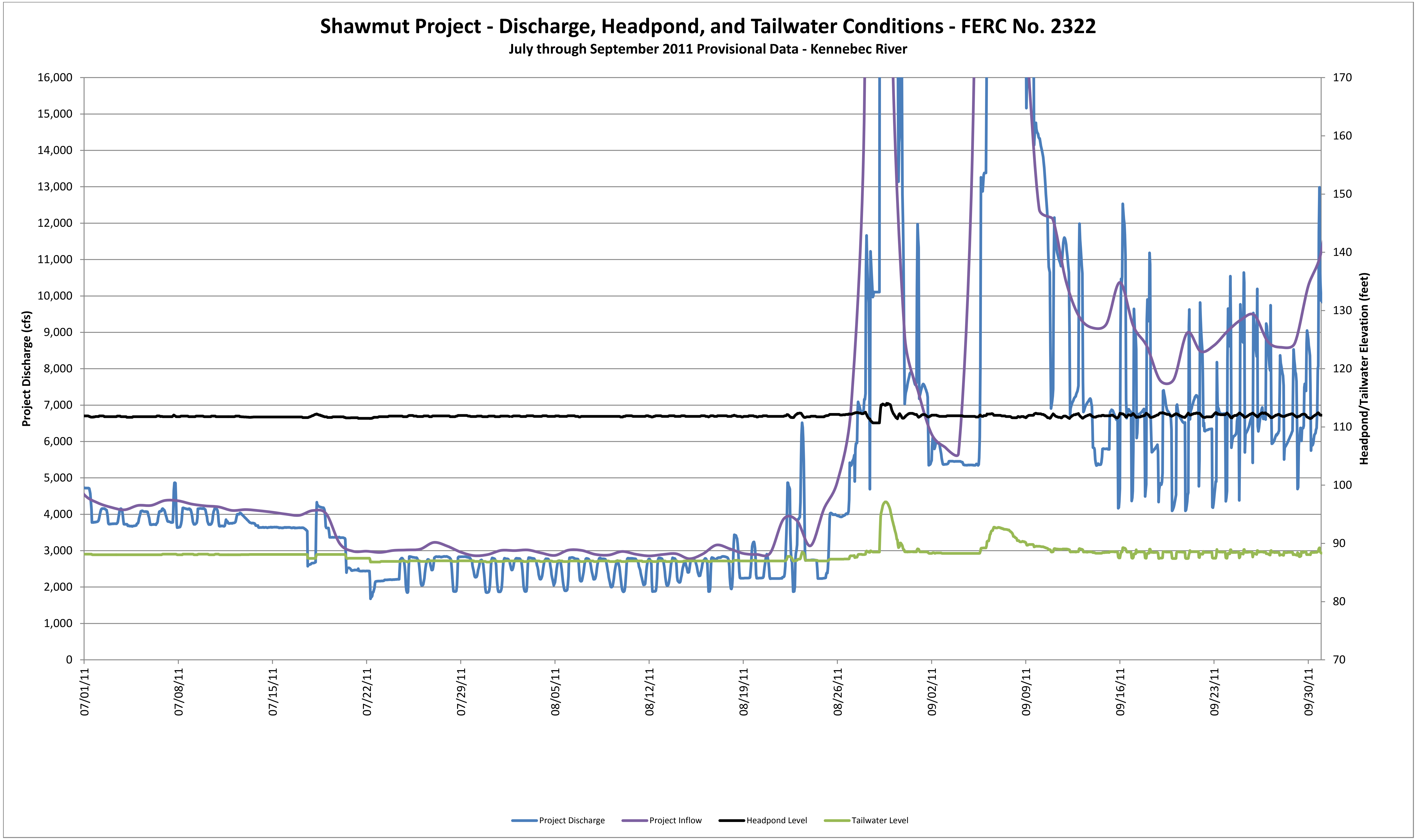

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2011 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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Headpond Level
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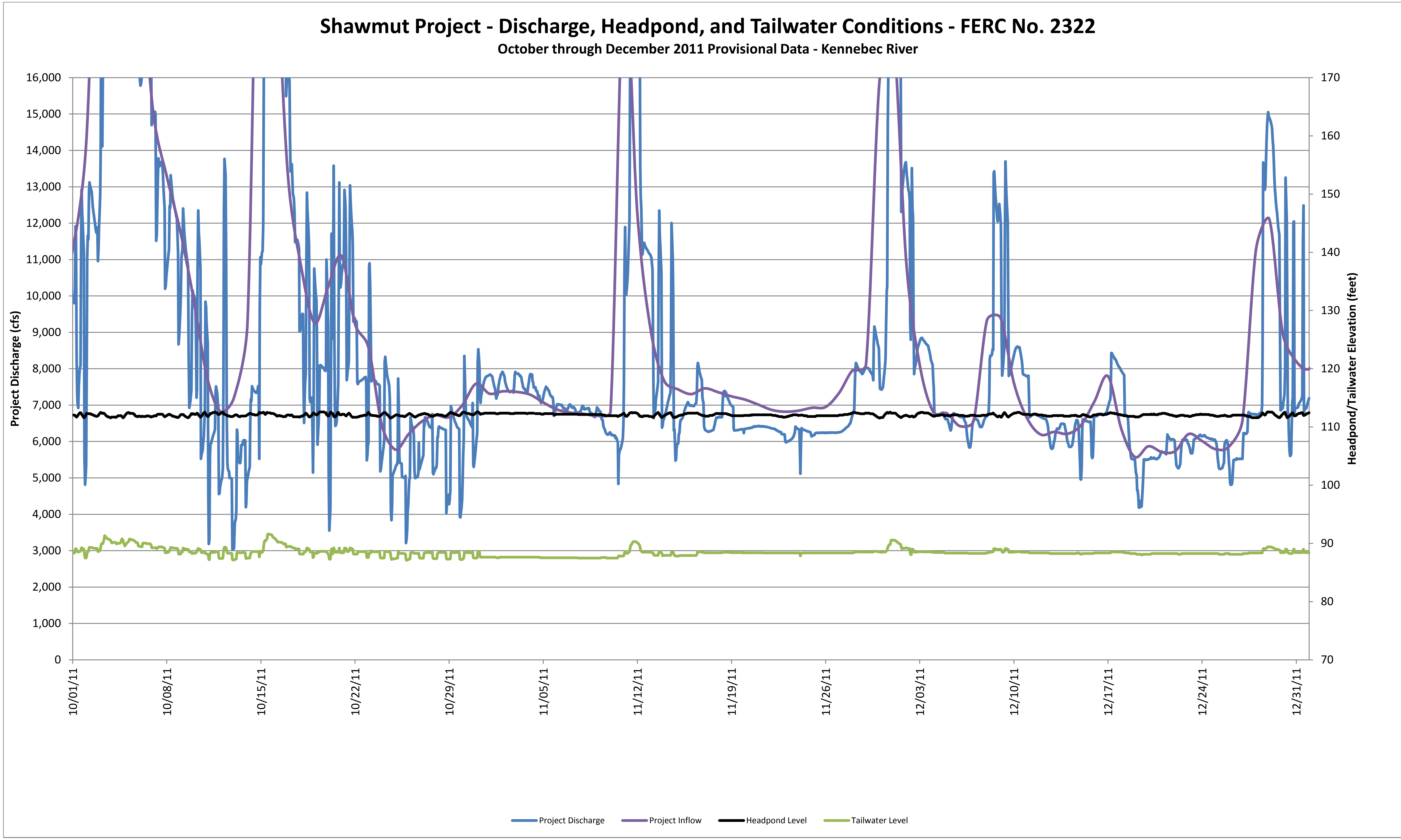
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2011 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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Headpond Level
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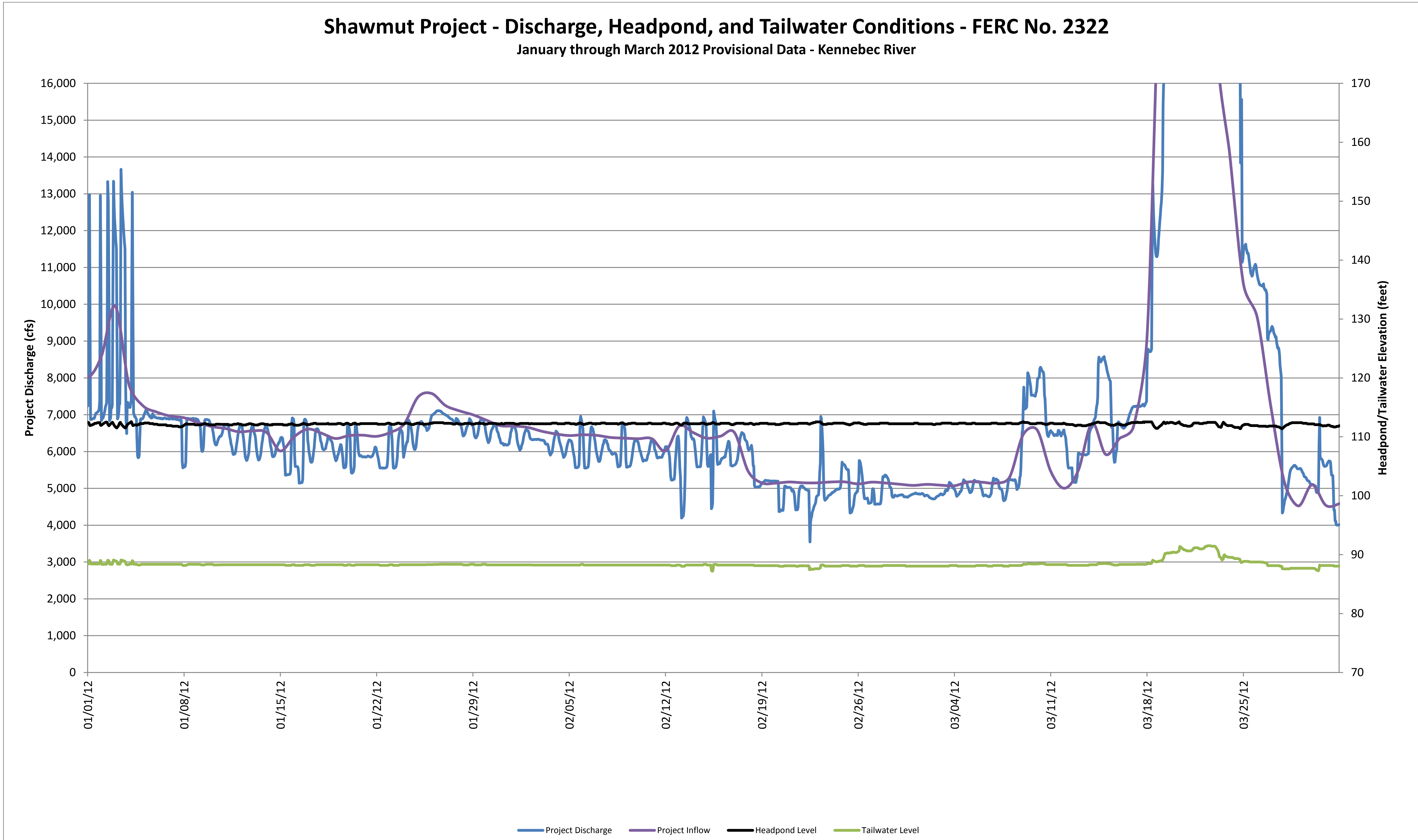
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2012 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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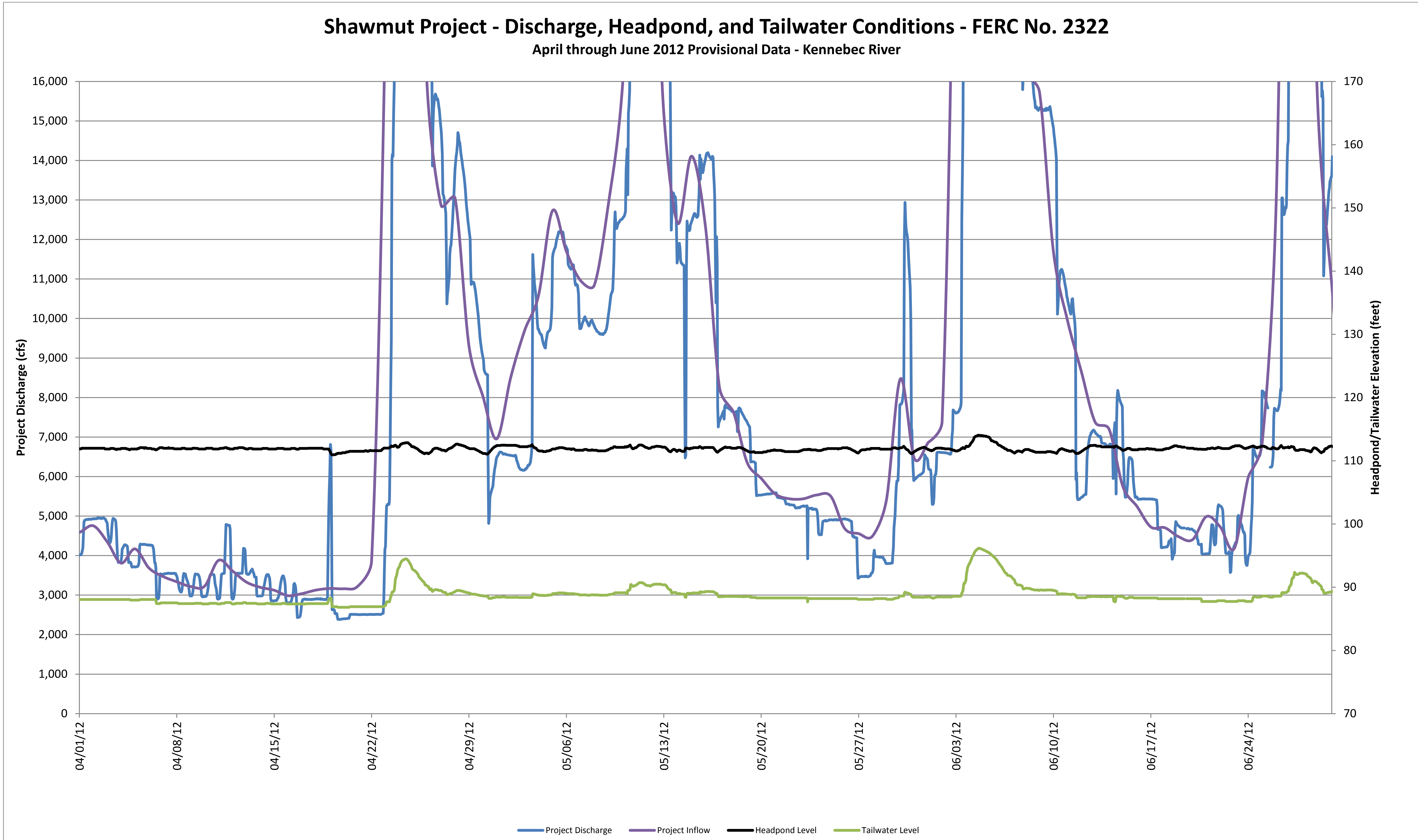

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2012 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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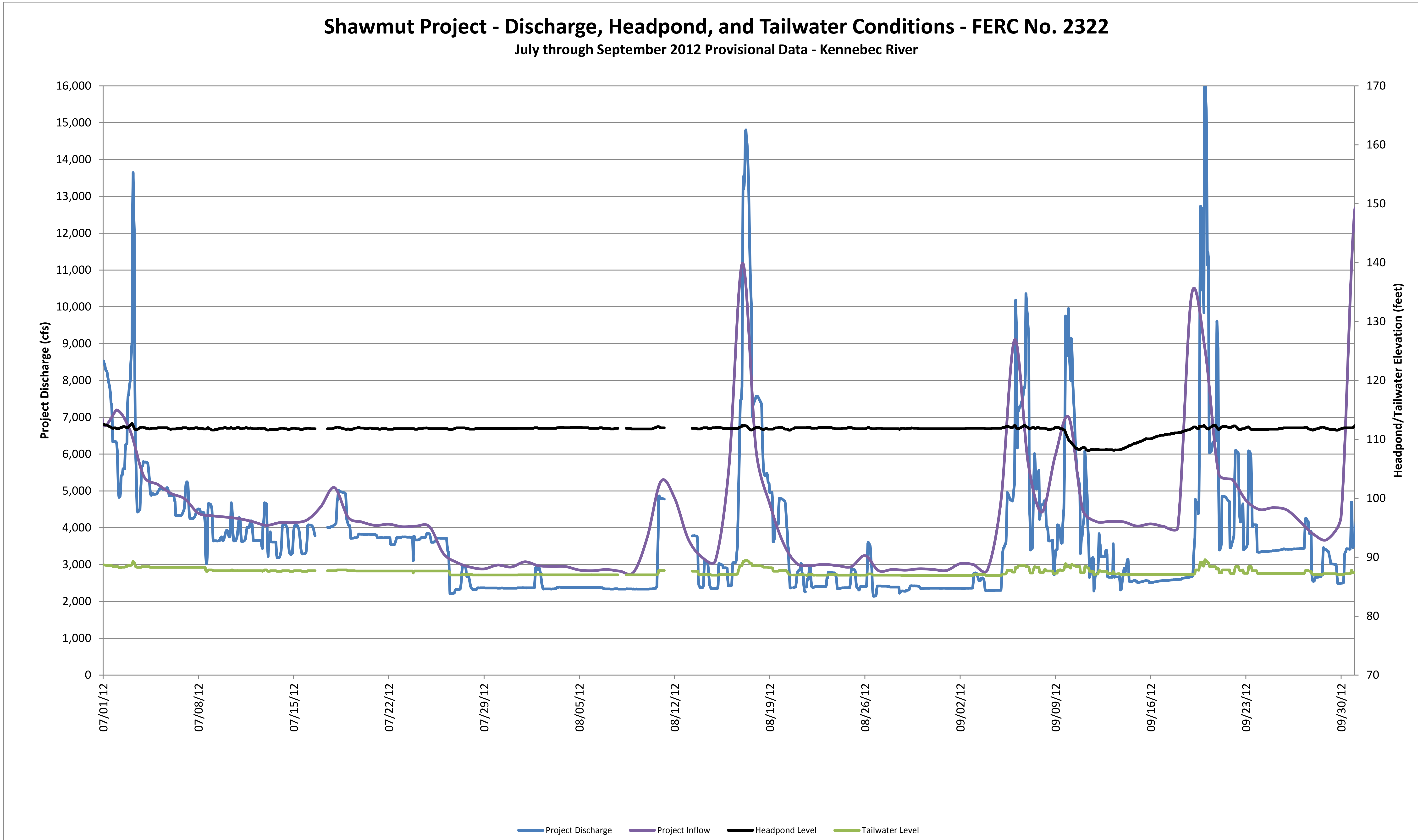
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2012 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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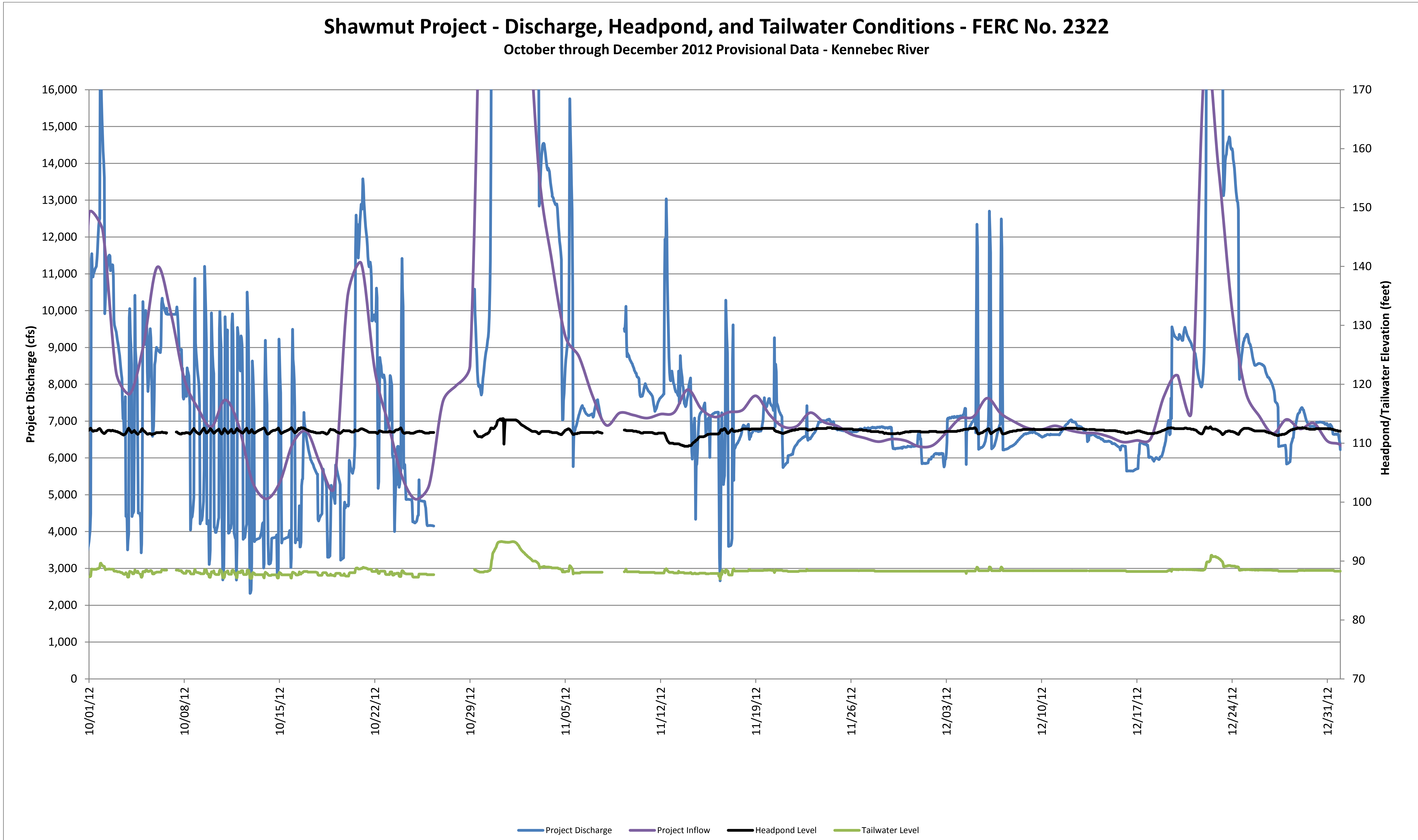

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2012 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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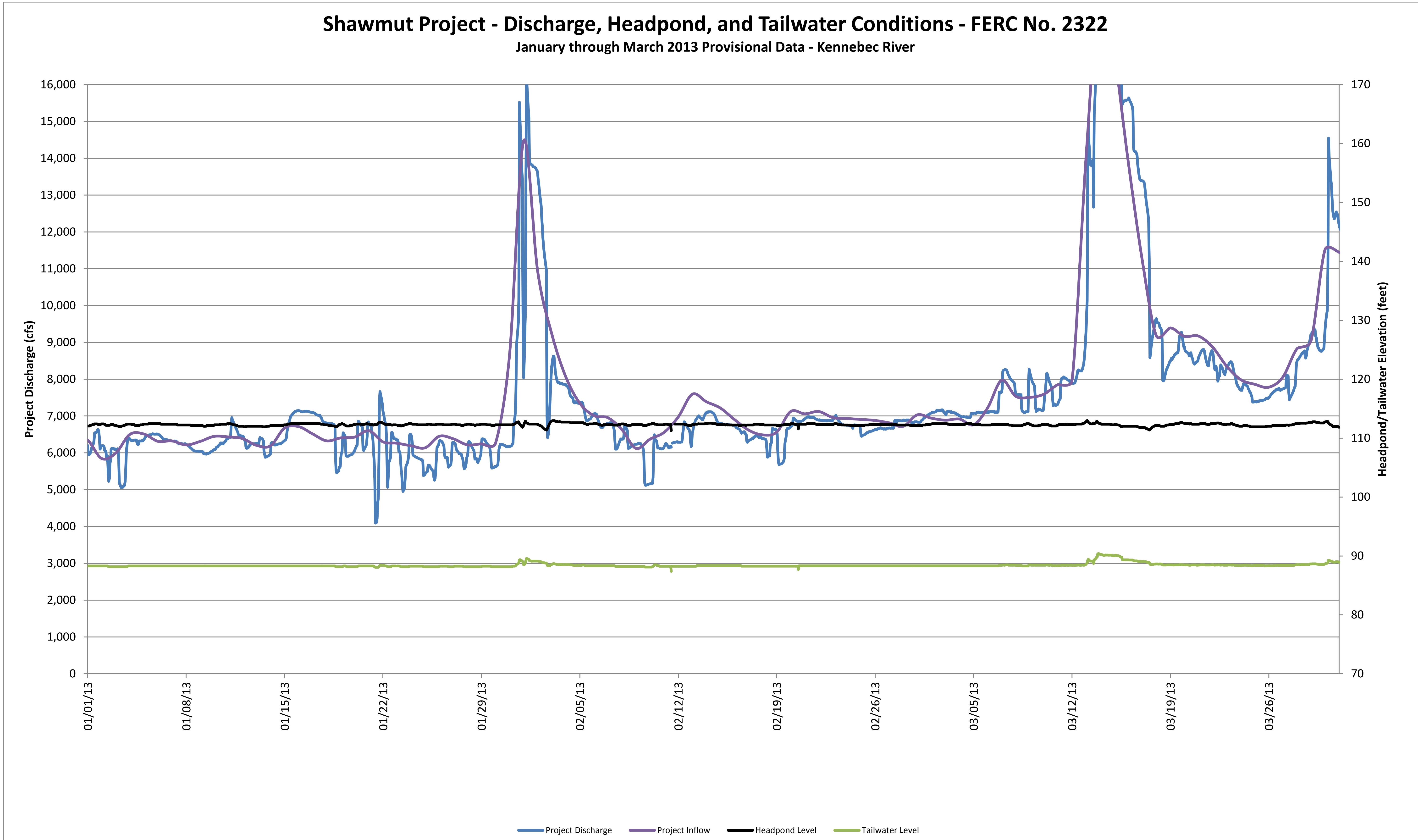
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2013 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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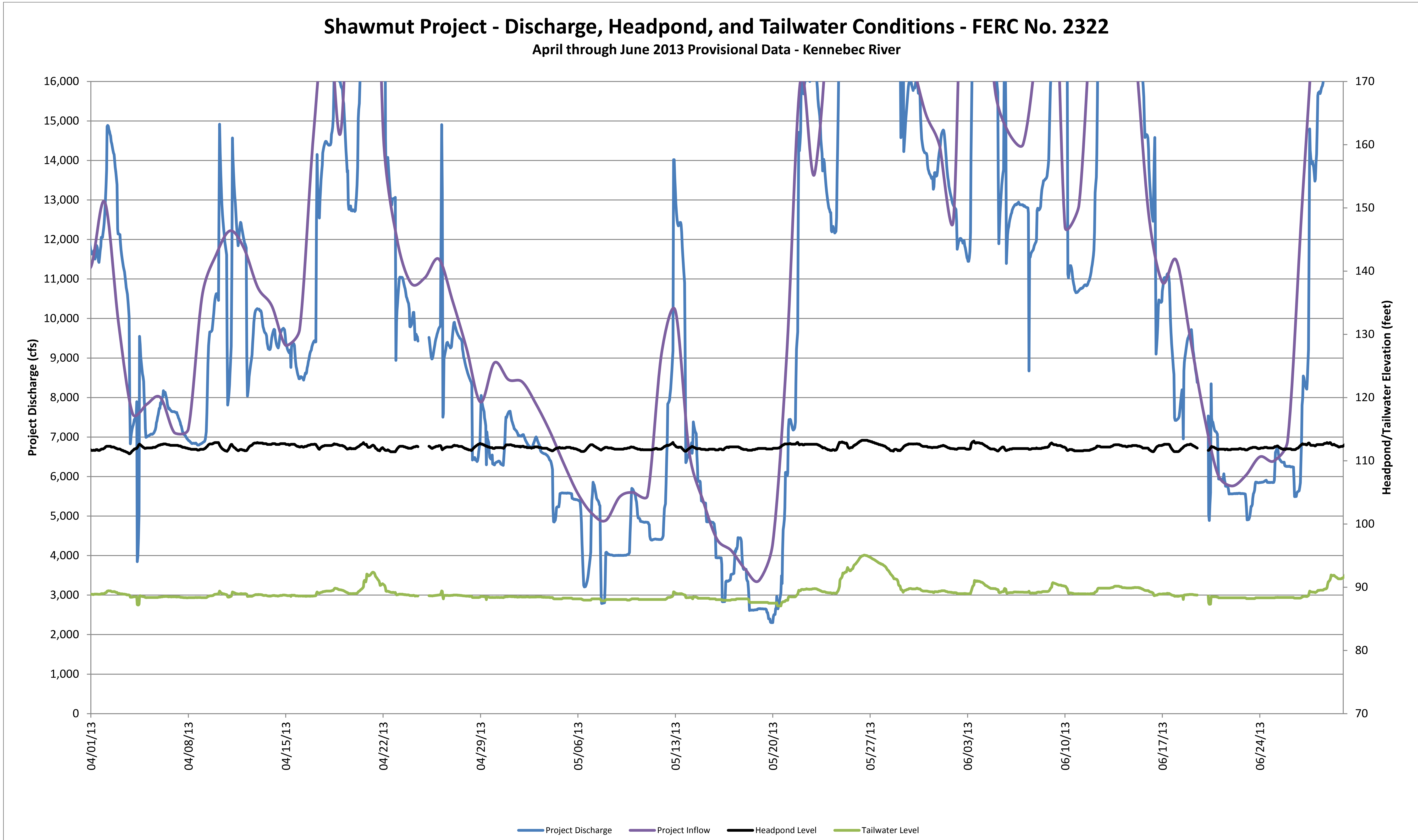

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2013 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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Headpond Level
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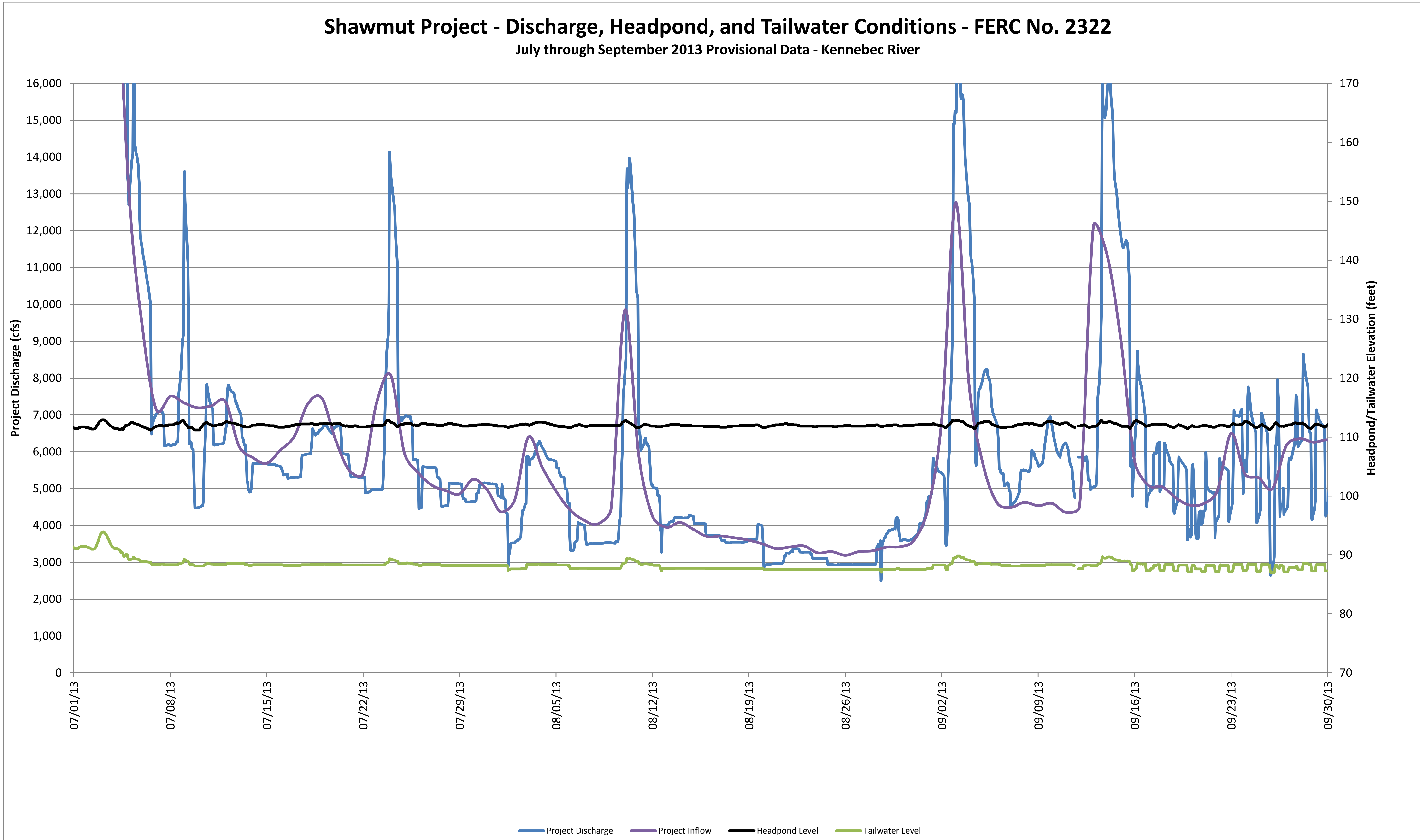
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2013 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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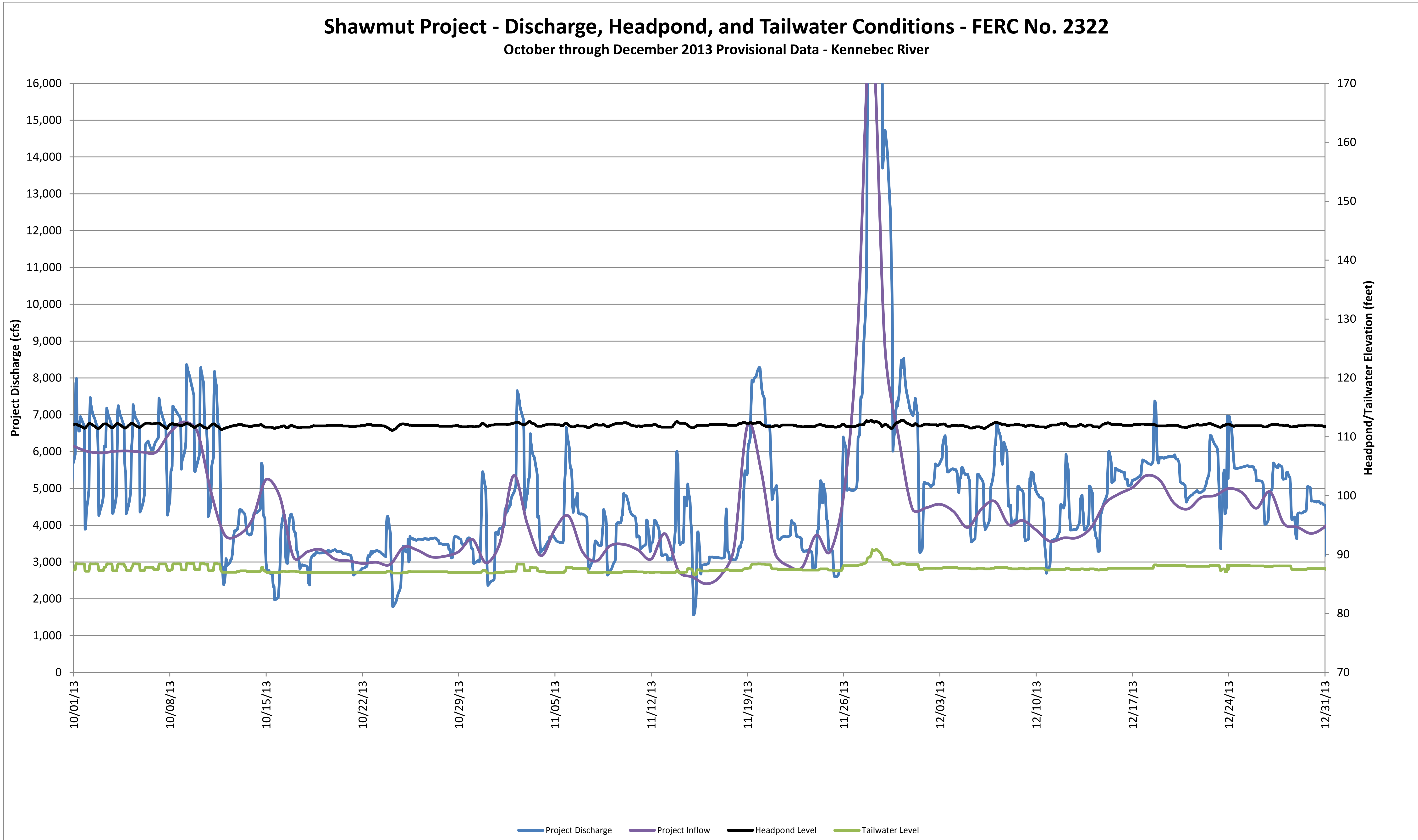
Project Discharge
Project Inflow
Headpond Level
Tailwater Level



Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2013 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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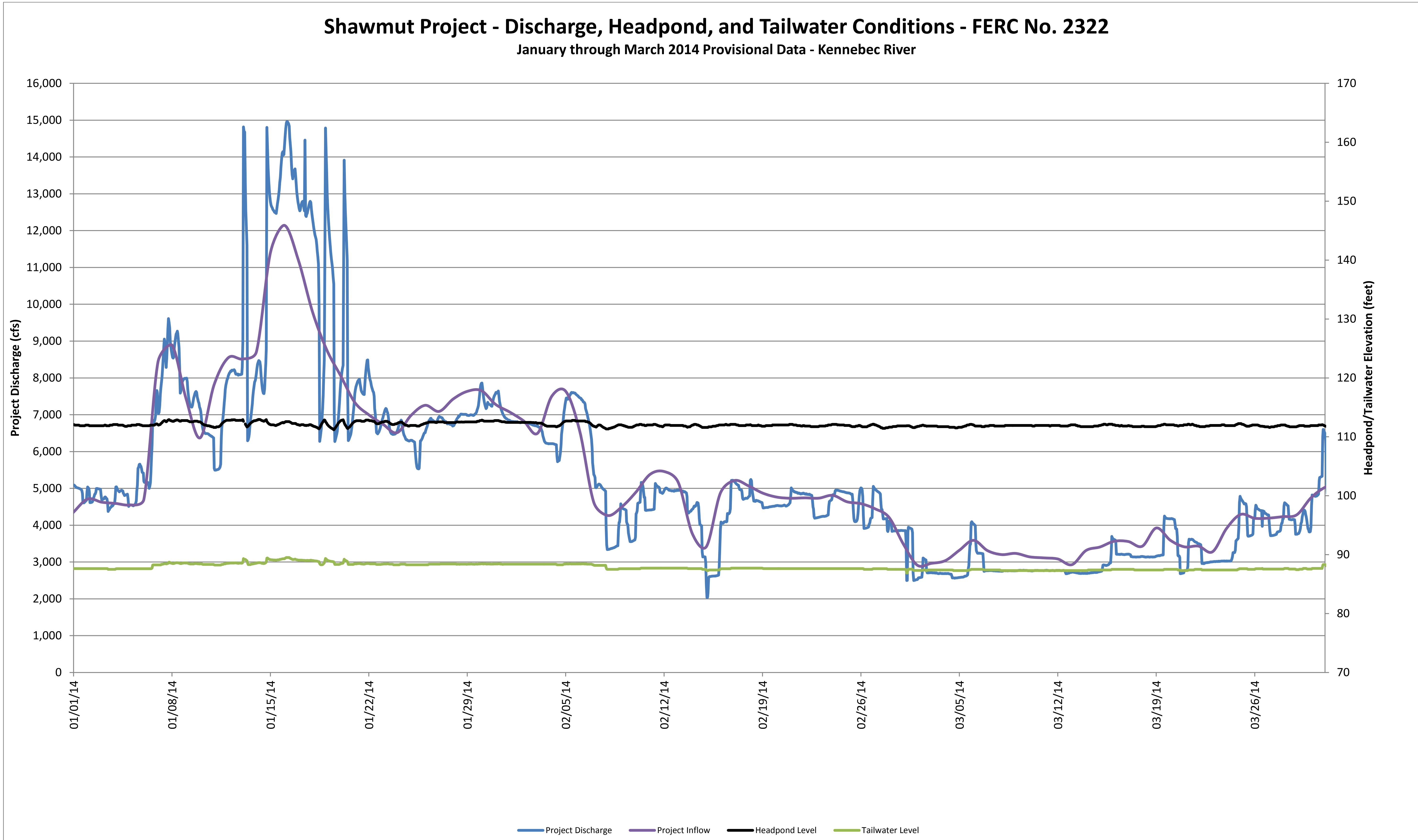

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2014 Provisional Data - Kennebec River
Project Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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Headpond Level
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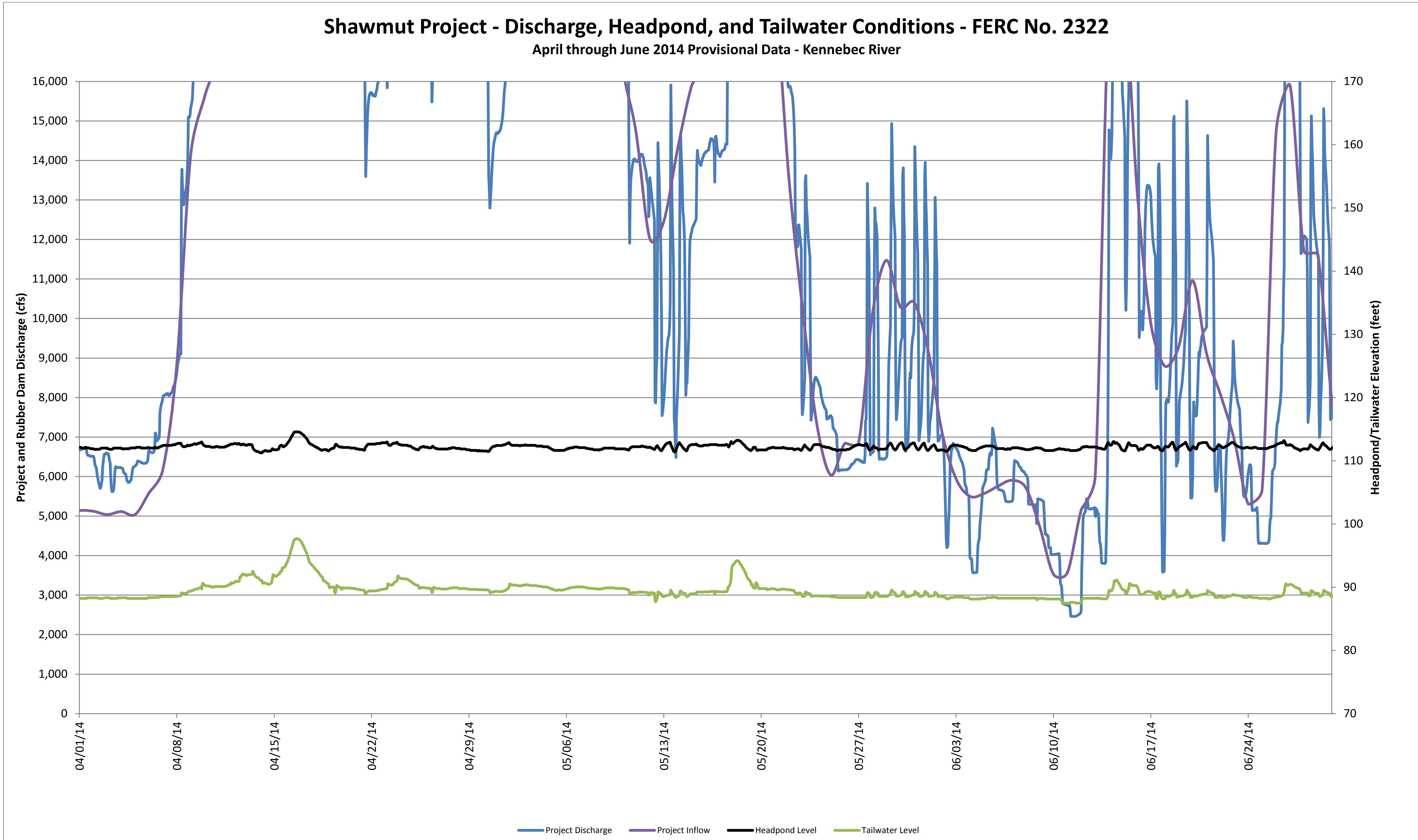
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2014 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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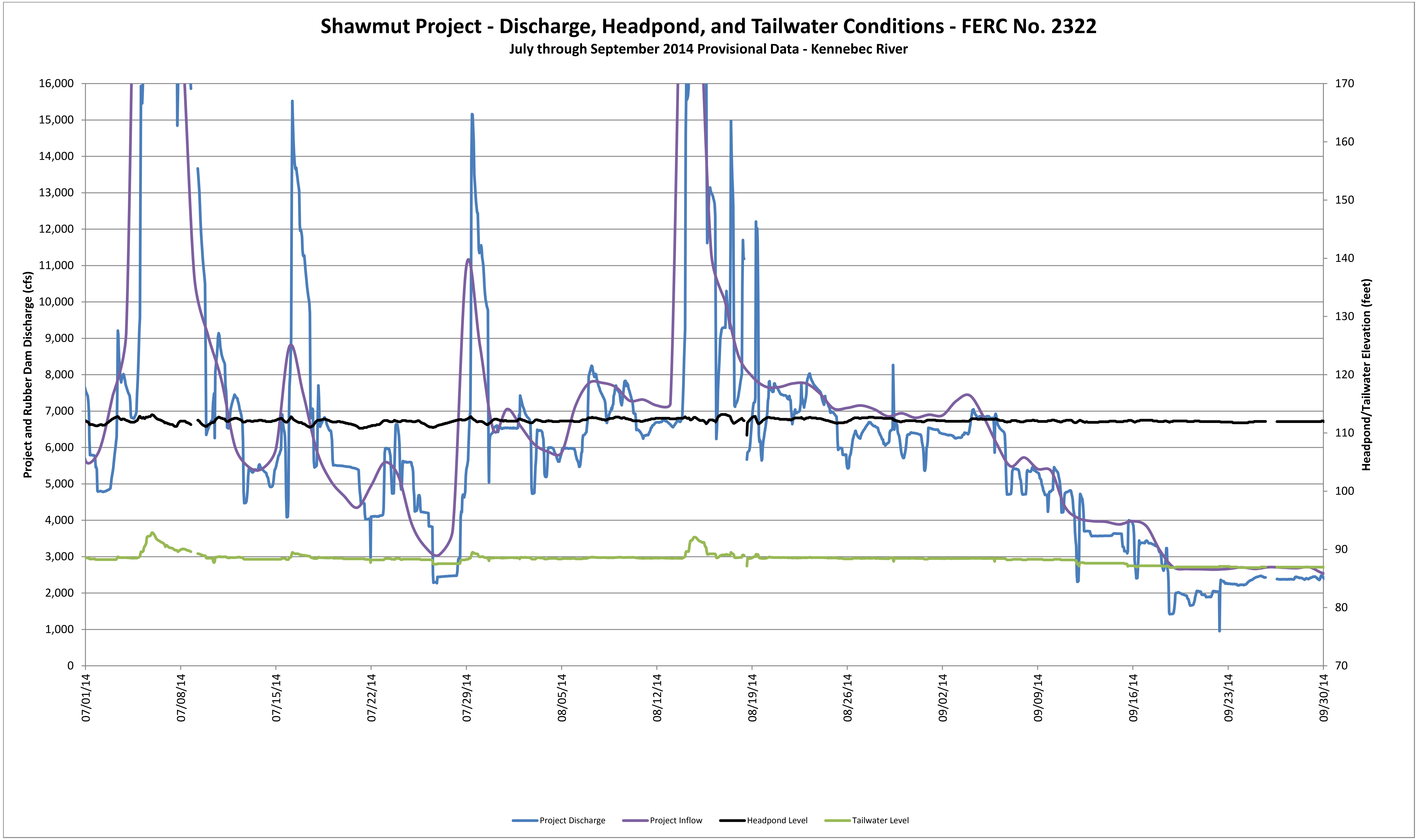

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2014 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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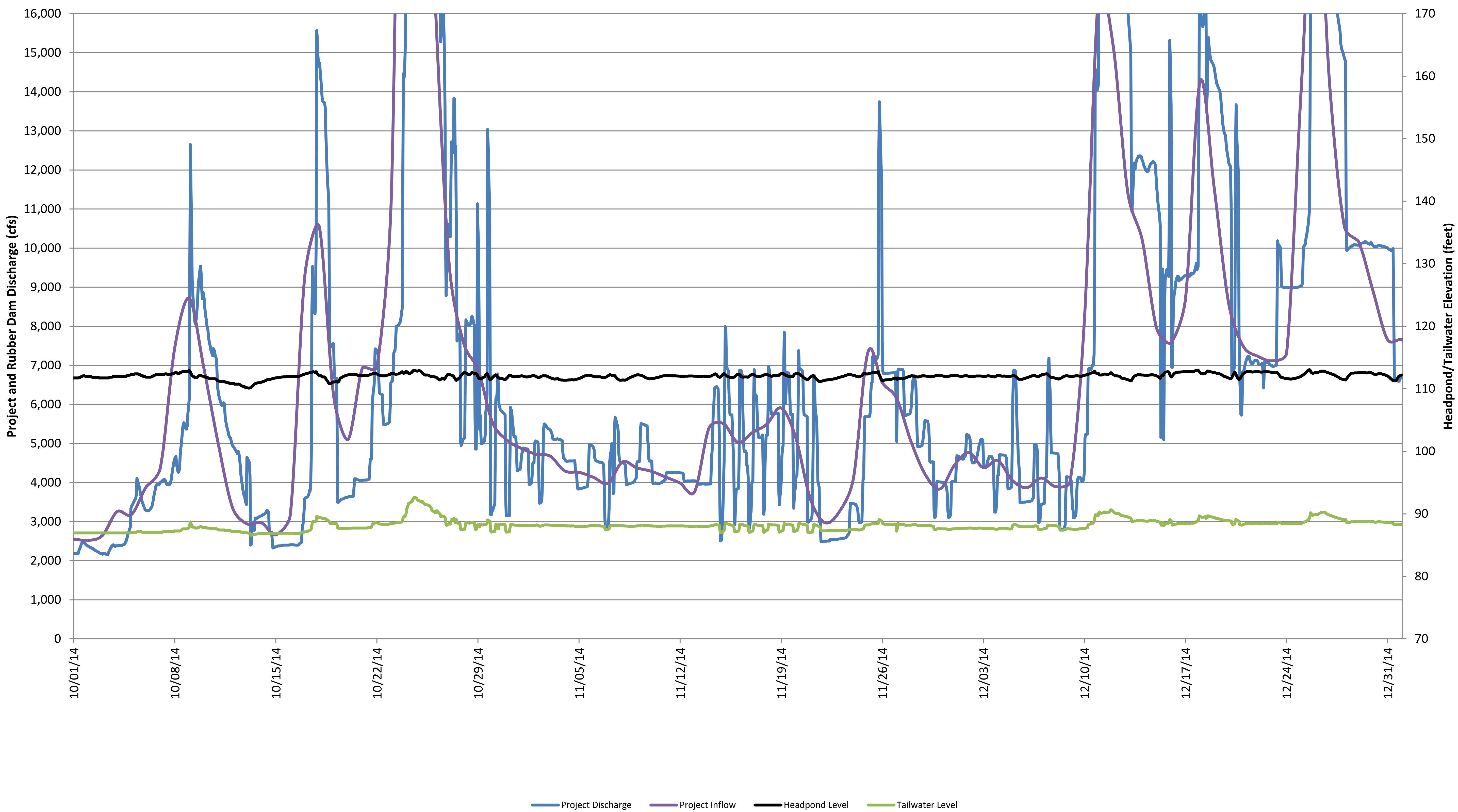
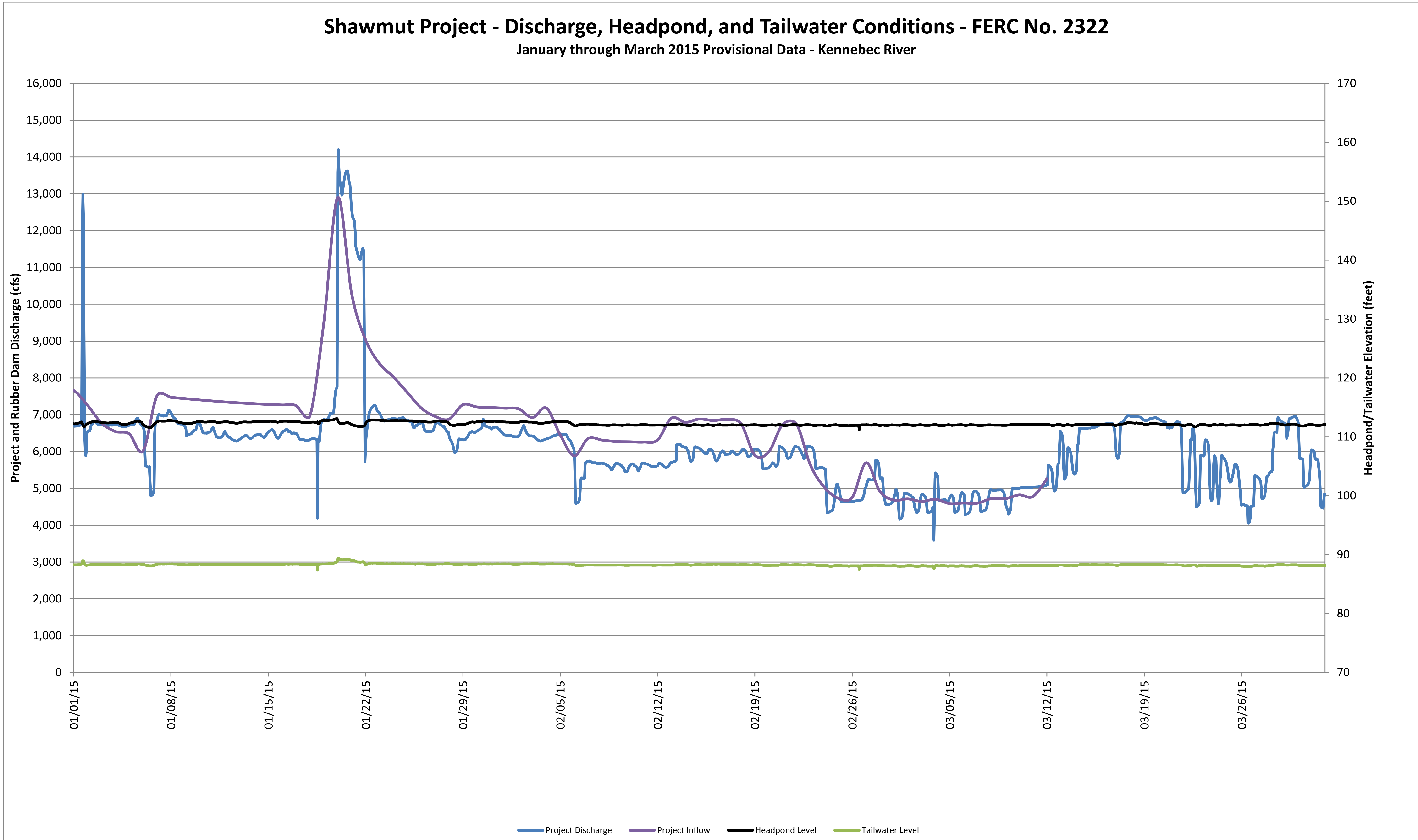
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322

October through December 2014 Provisional Data - Kennebec River




Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
January through March 2015 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
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Project Discharge
Project Inflow
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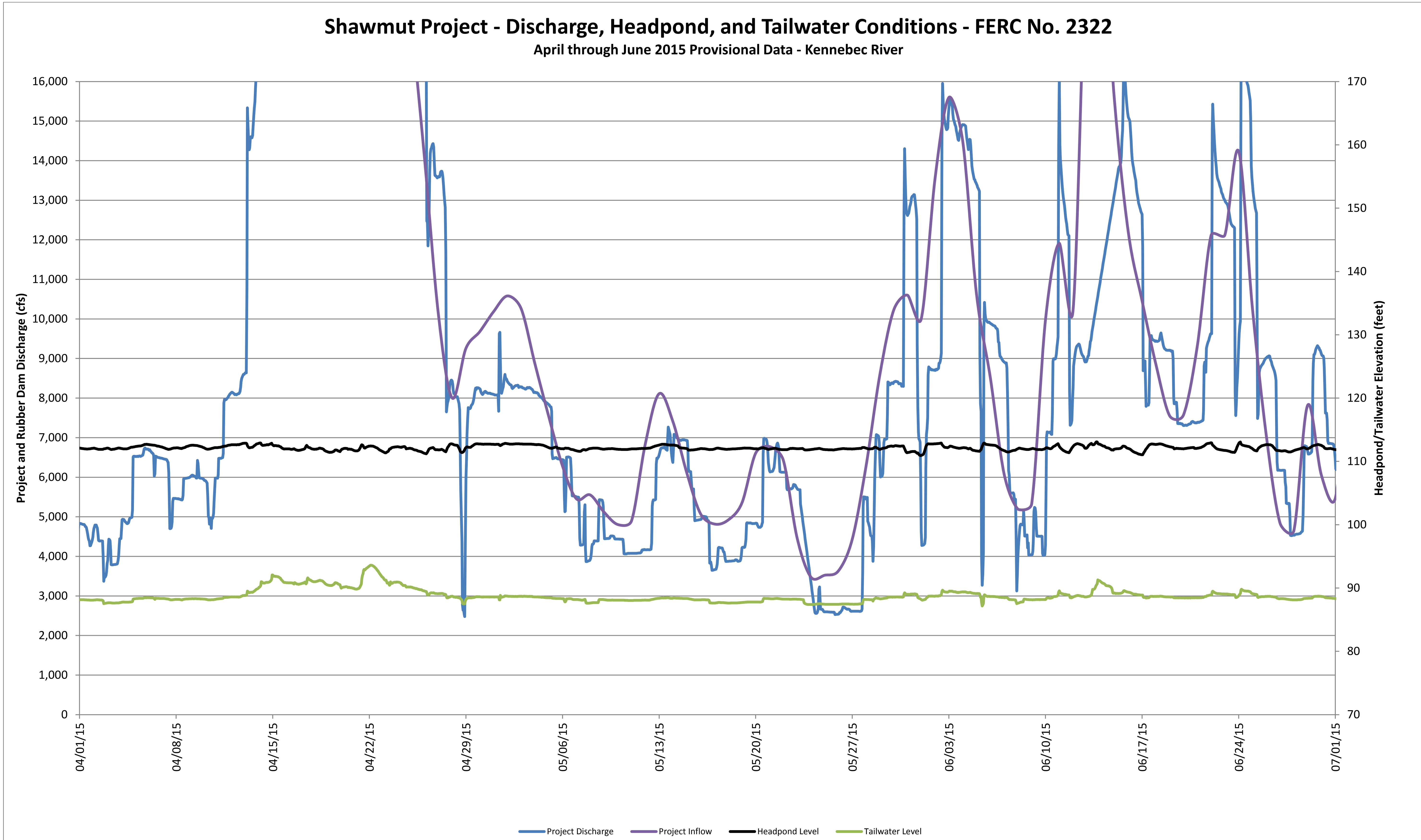
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
April through June 2015 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
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Project Discharge
Project Inflow
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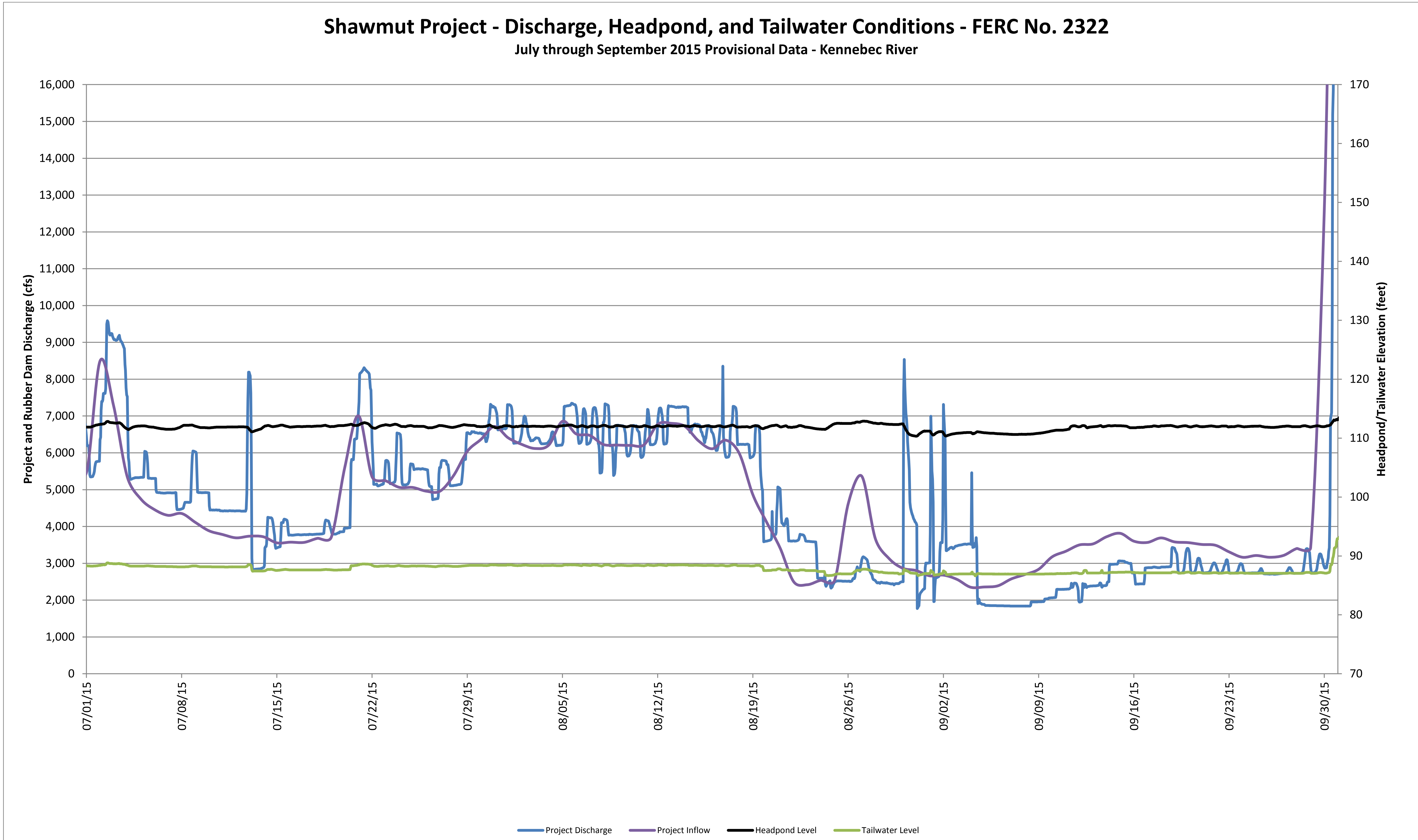

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
July through September 2015 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
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Project Discharge
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Headpond Level
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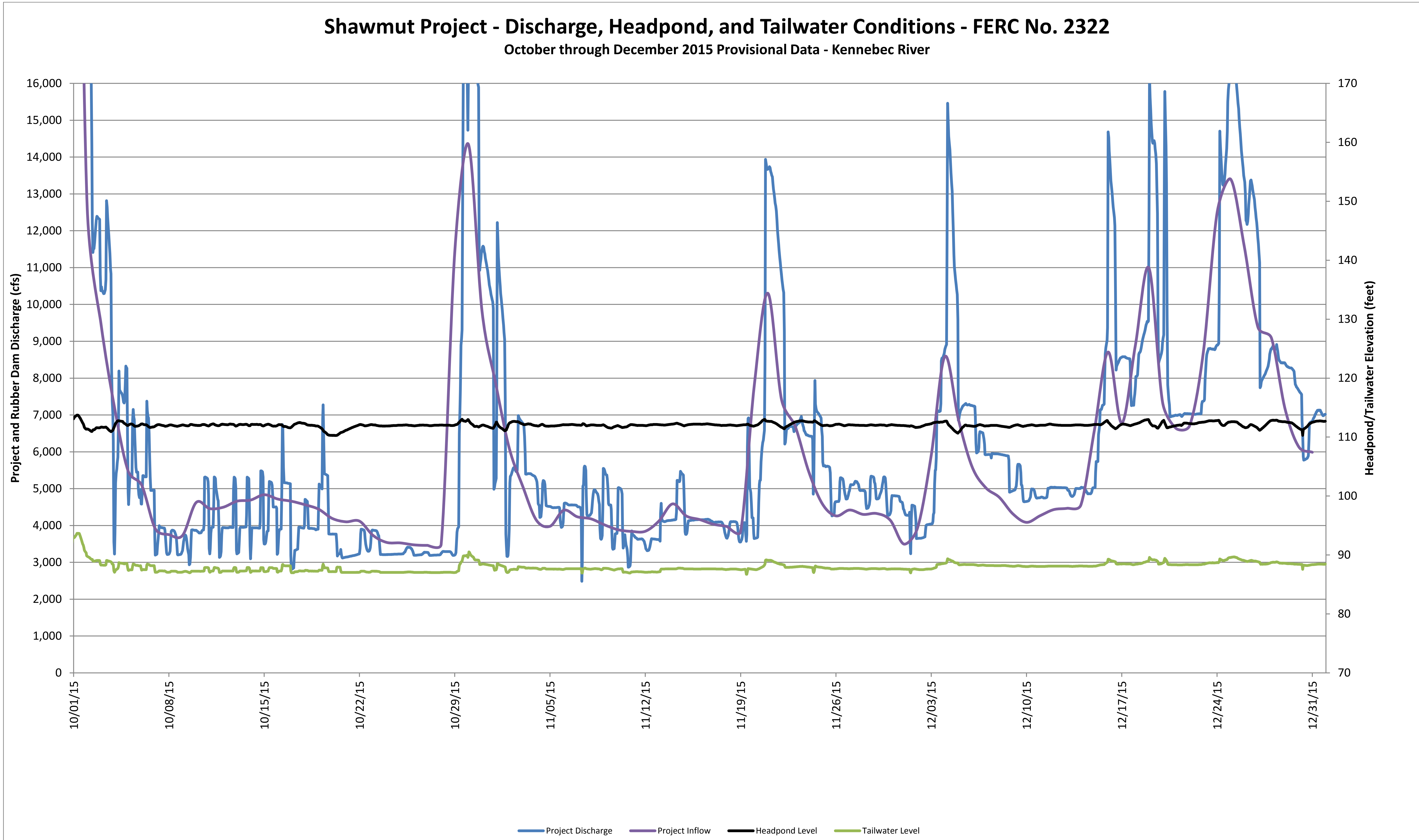

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No. 2322
October through December 2015 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
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Project Discharge
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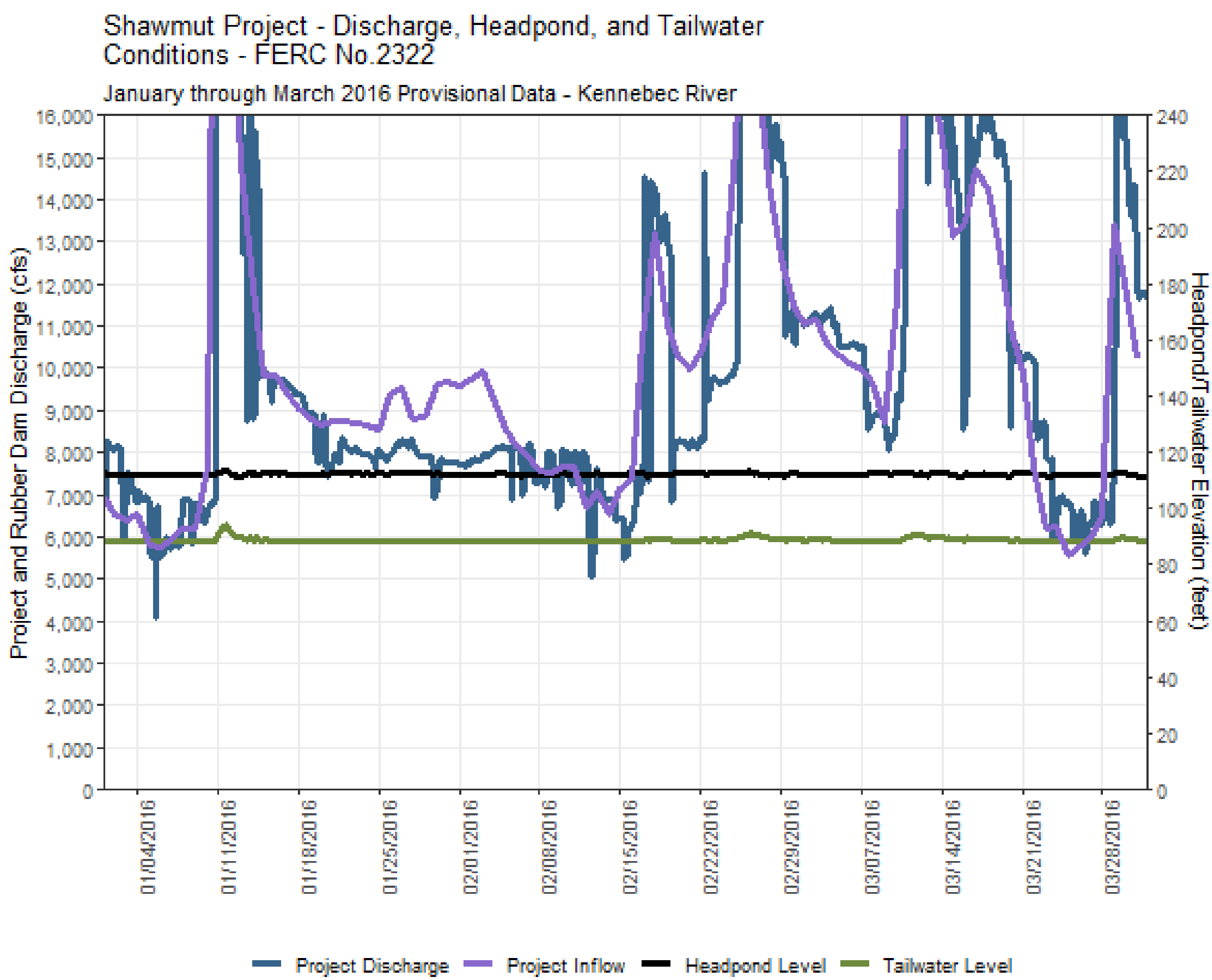

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322
January through March 2016 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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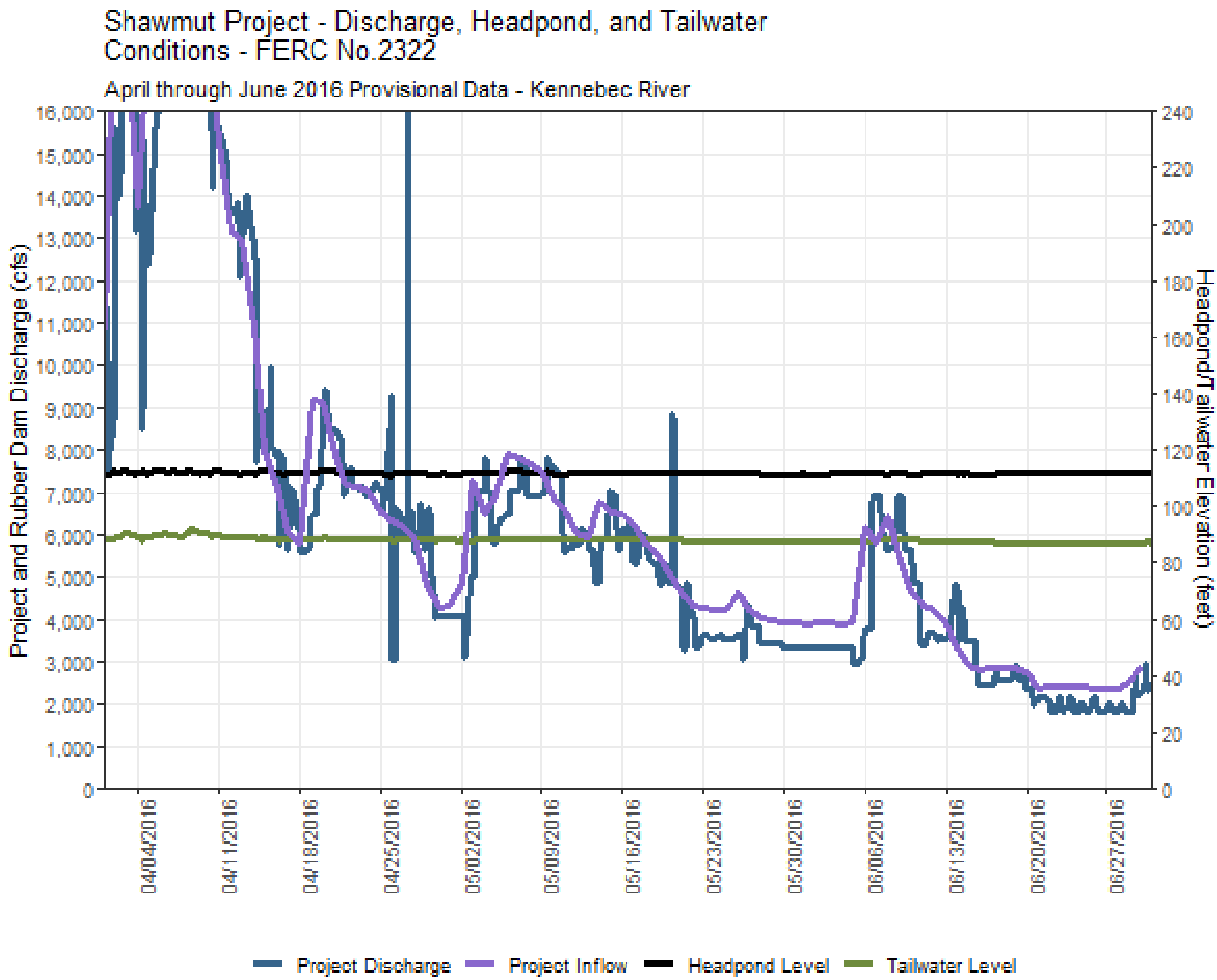

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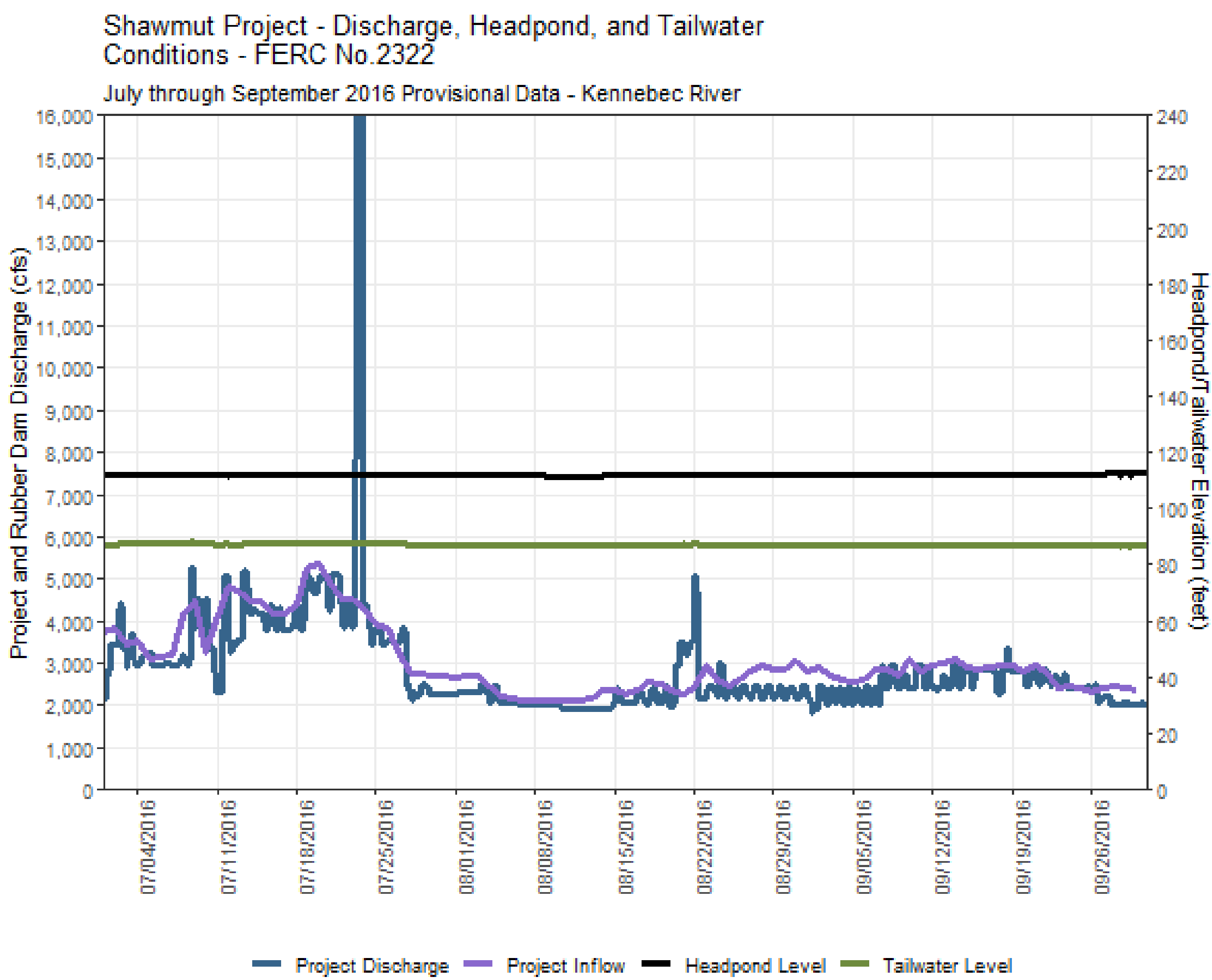
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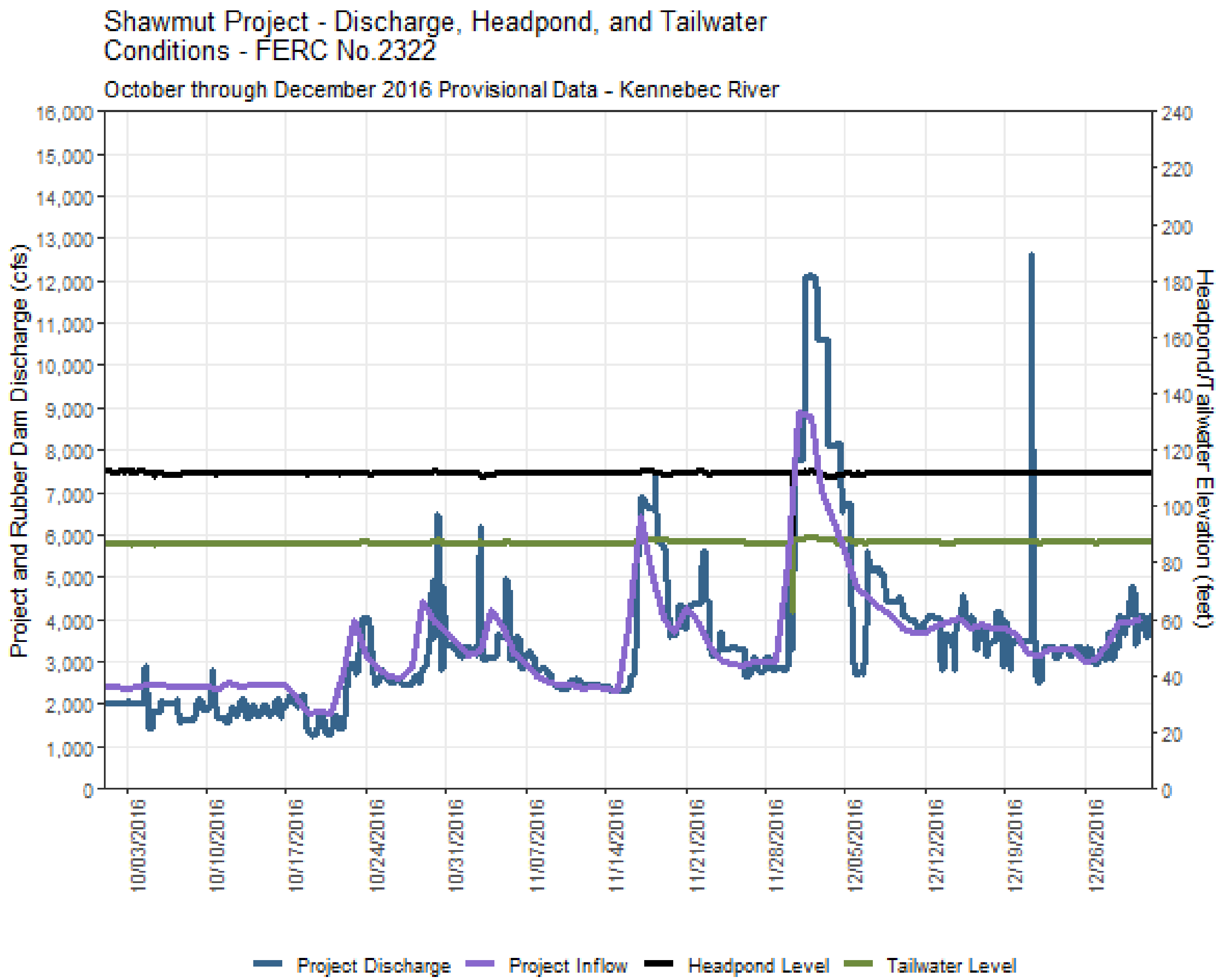

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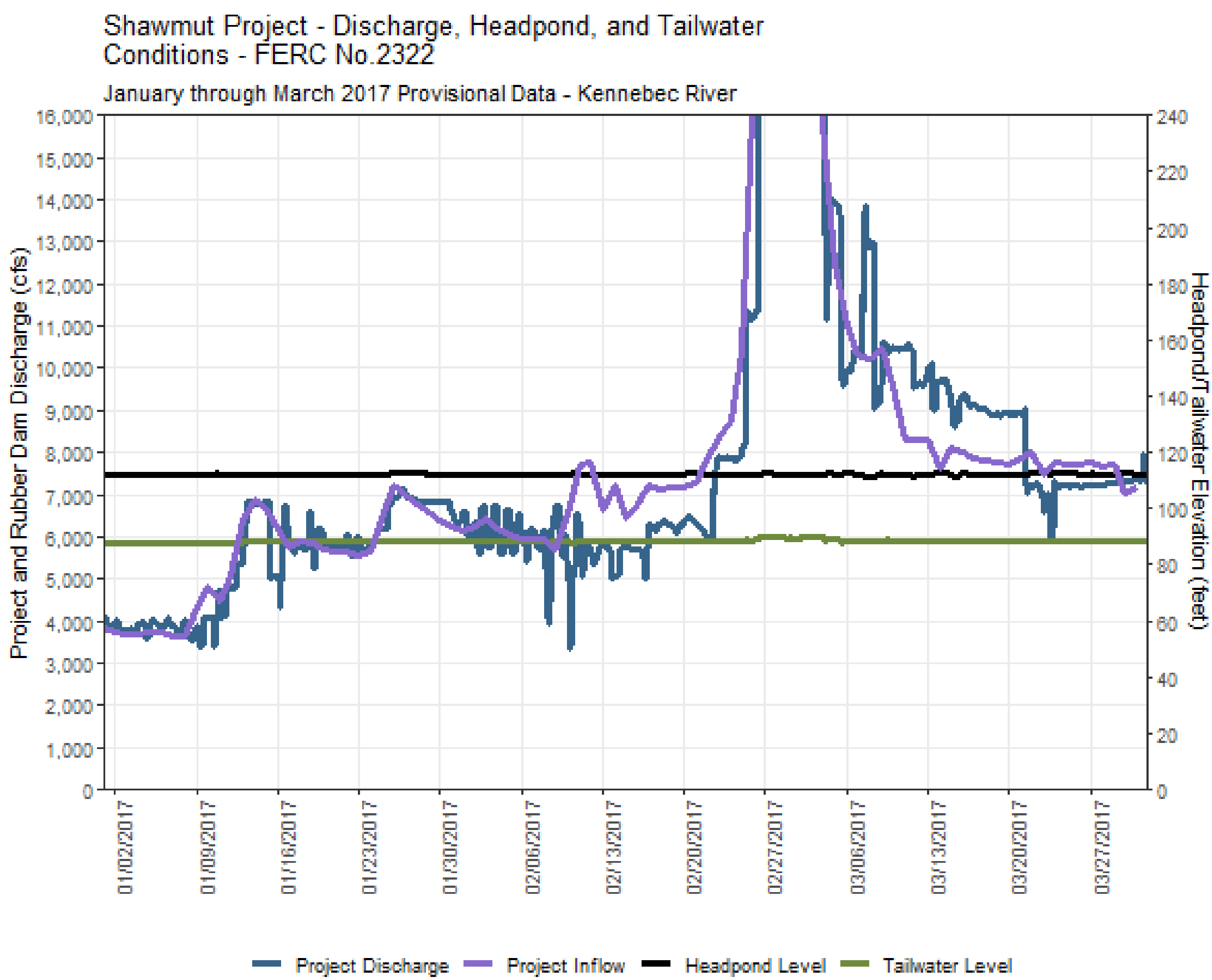

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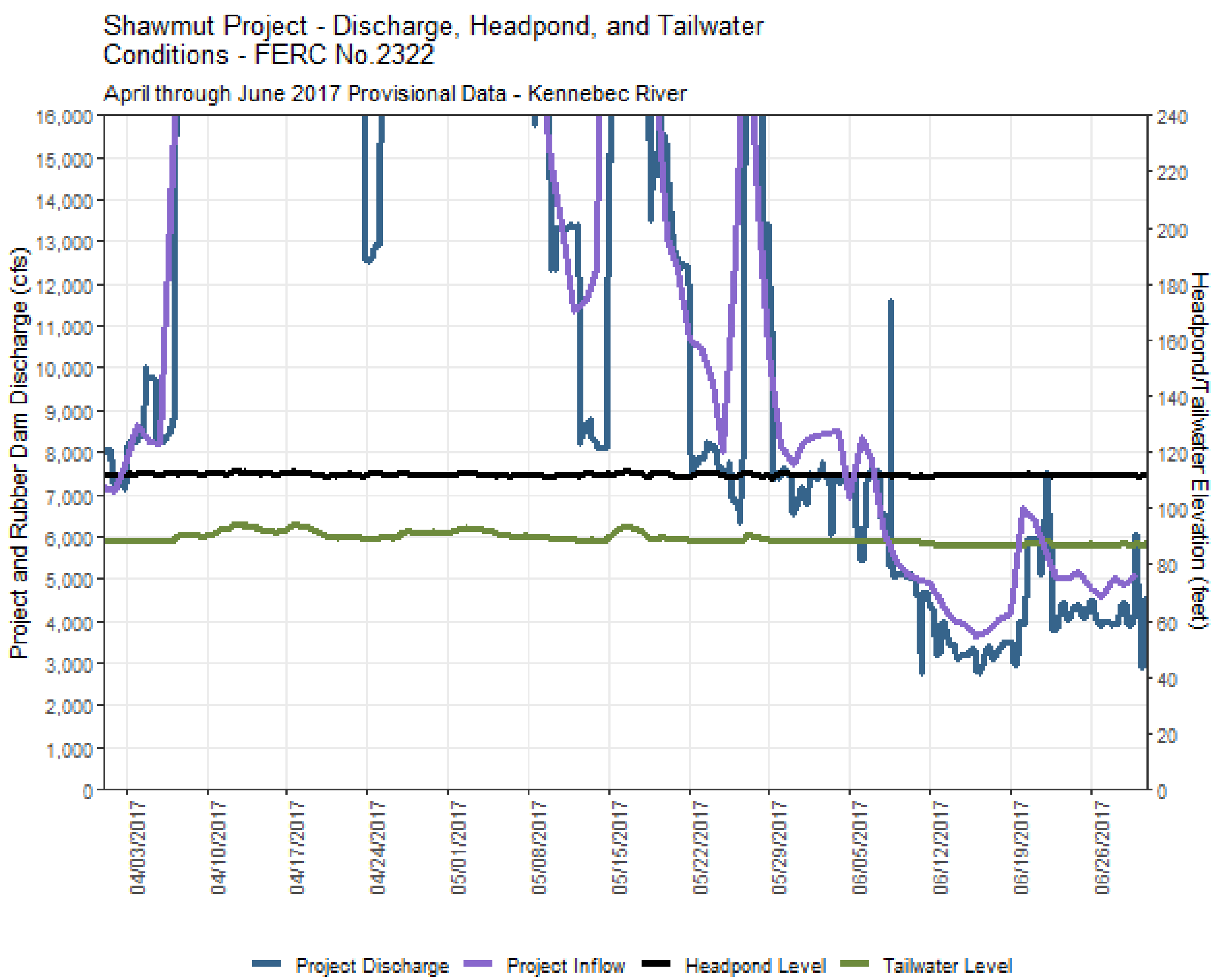

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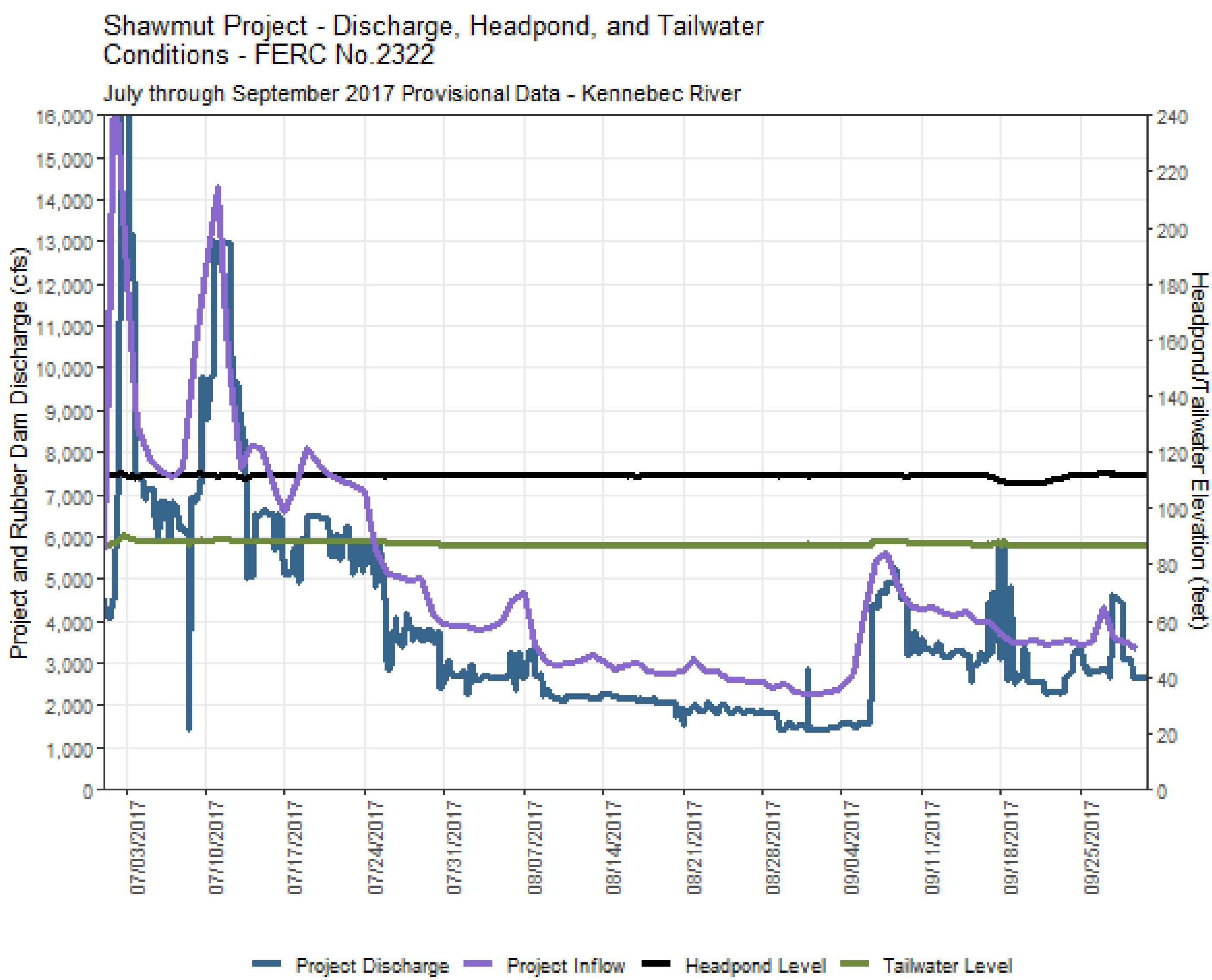
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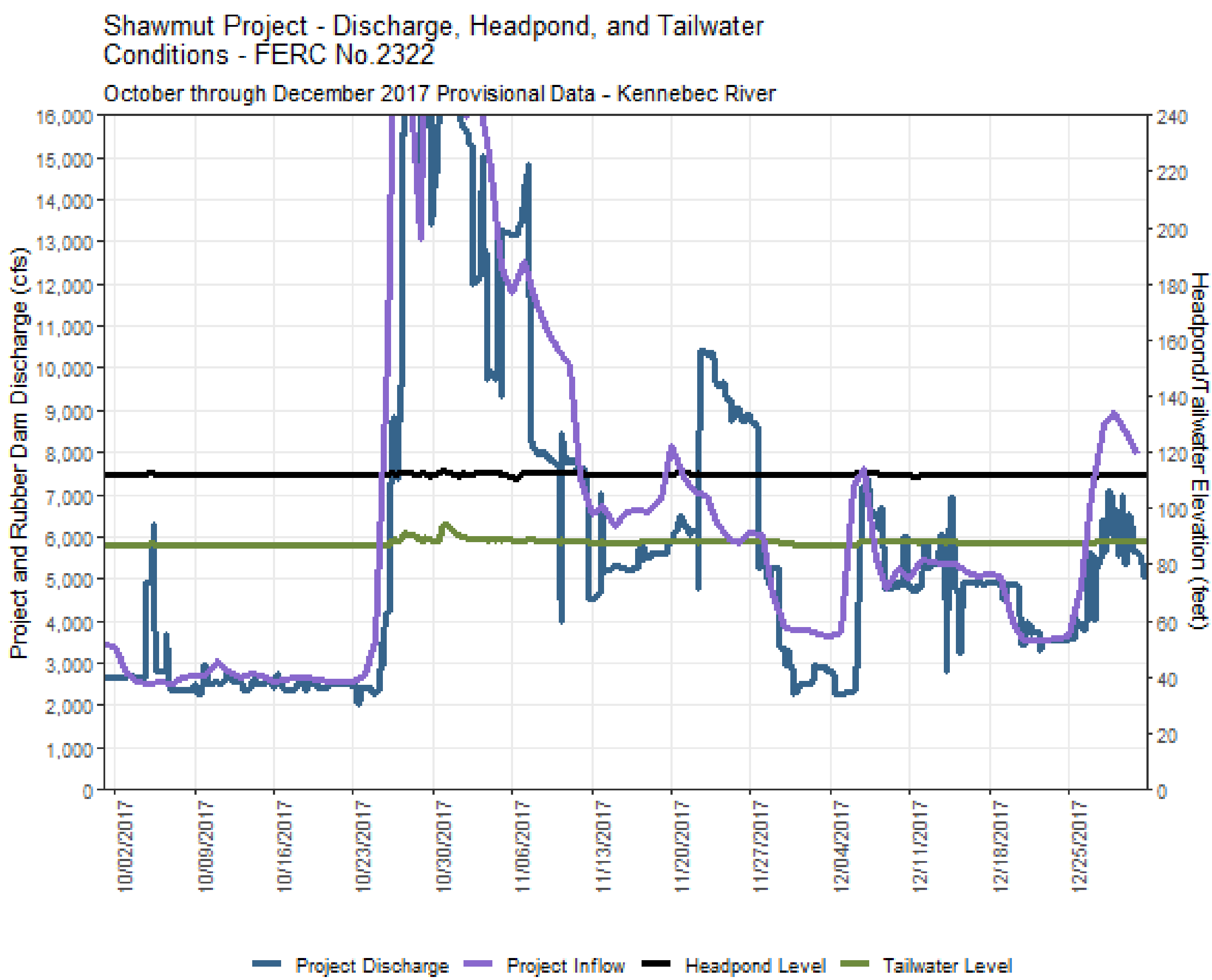

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322
October through December 2017 Provisional Data - Kennebec River
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Headpond/Tailwater Elevation (feet)
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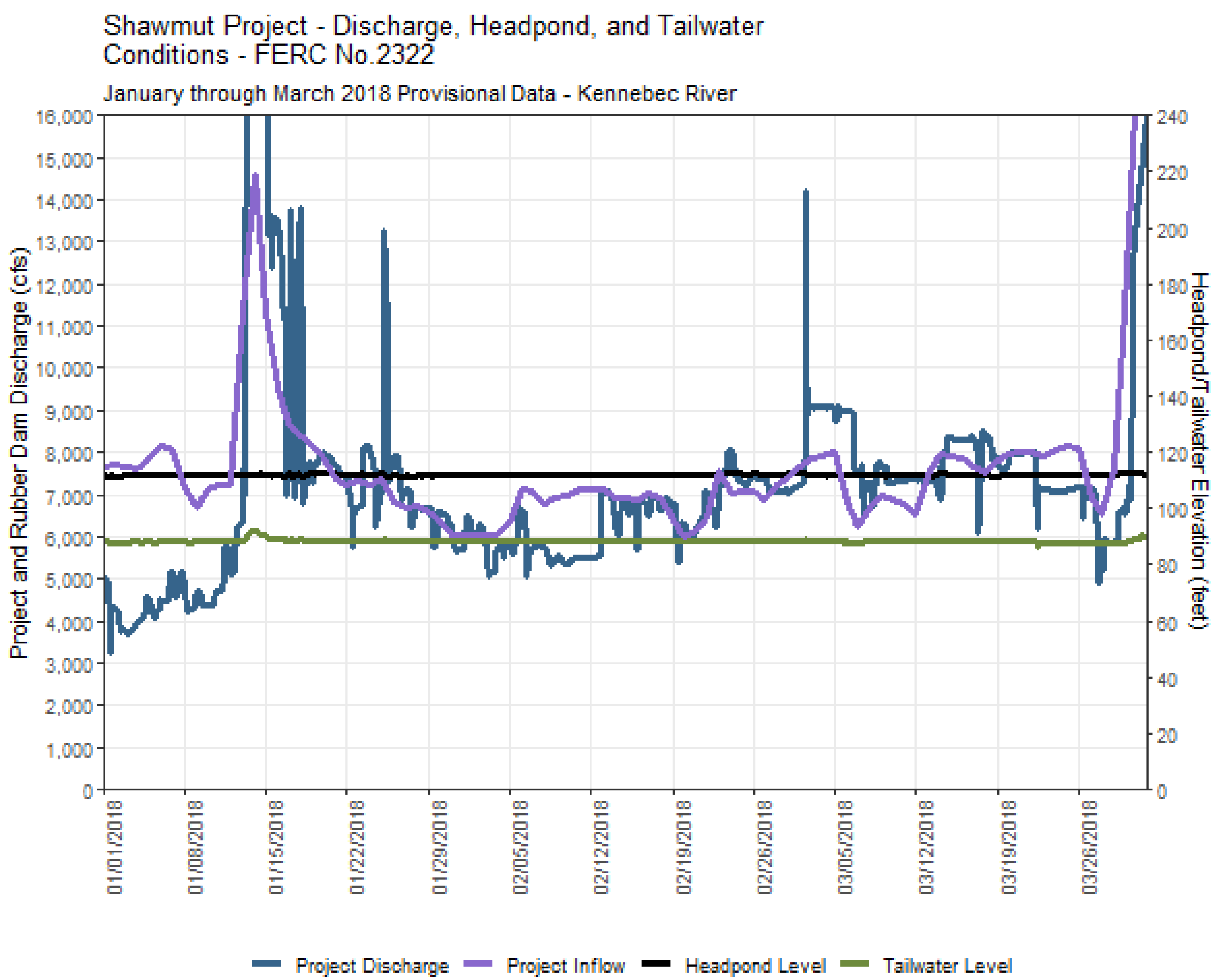

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322
January through March 2018 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
Project Inflow
Headpond Level
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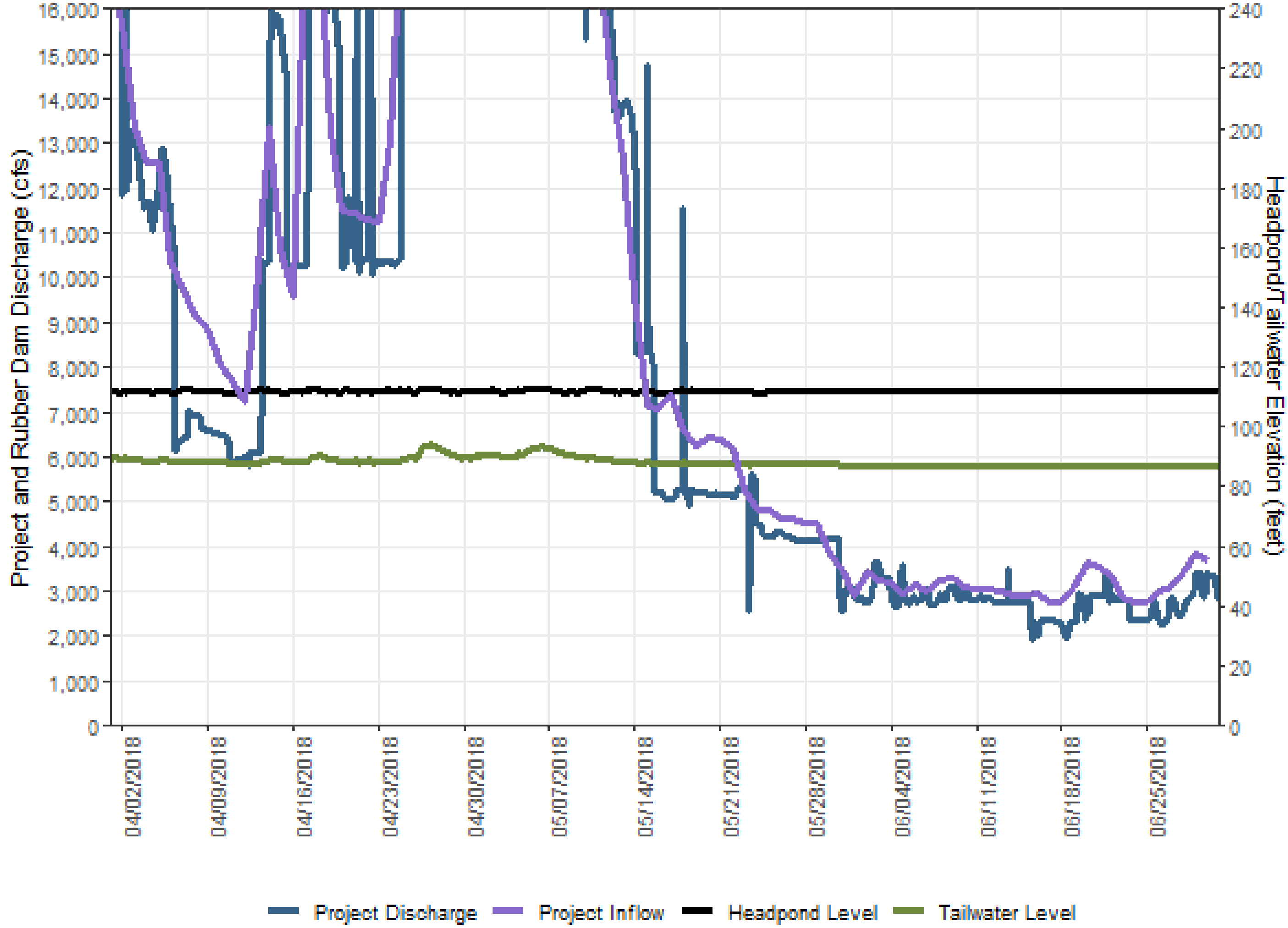
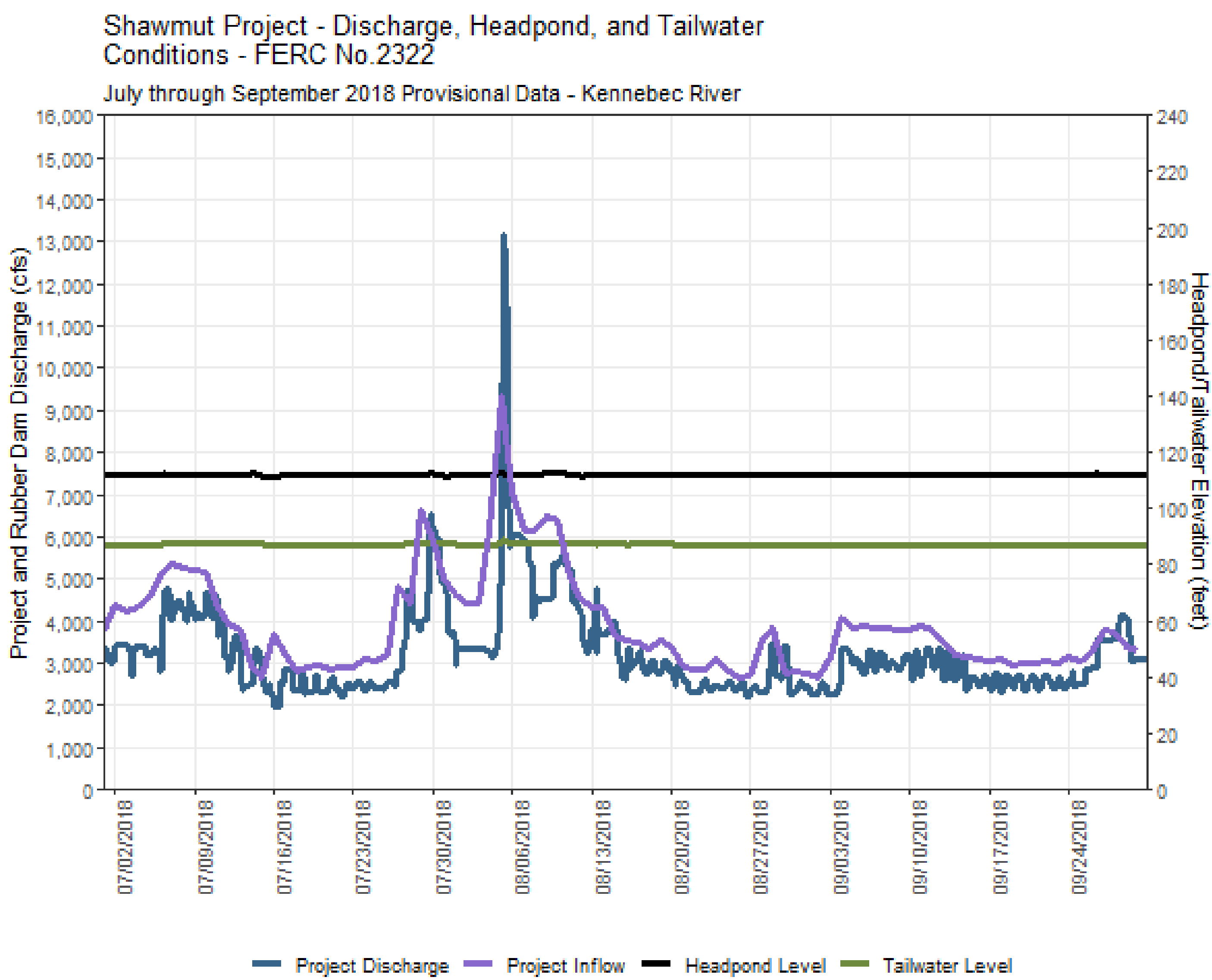
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322

April through June 2018 Provisional Data - Kennebec River

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Conditions - FERC No.2322
July through September 2018 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
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Project Discharge
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Headpond Level
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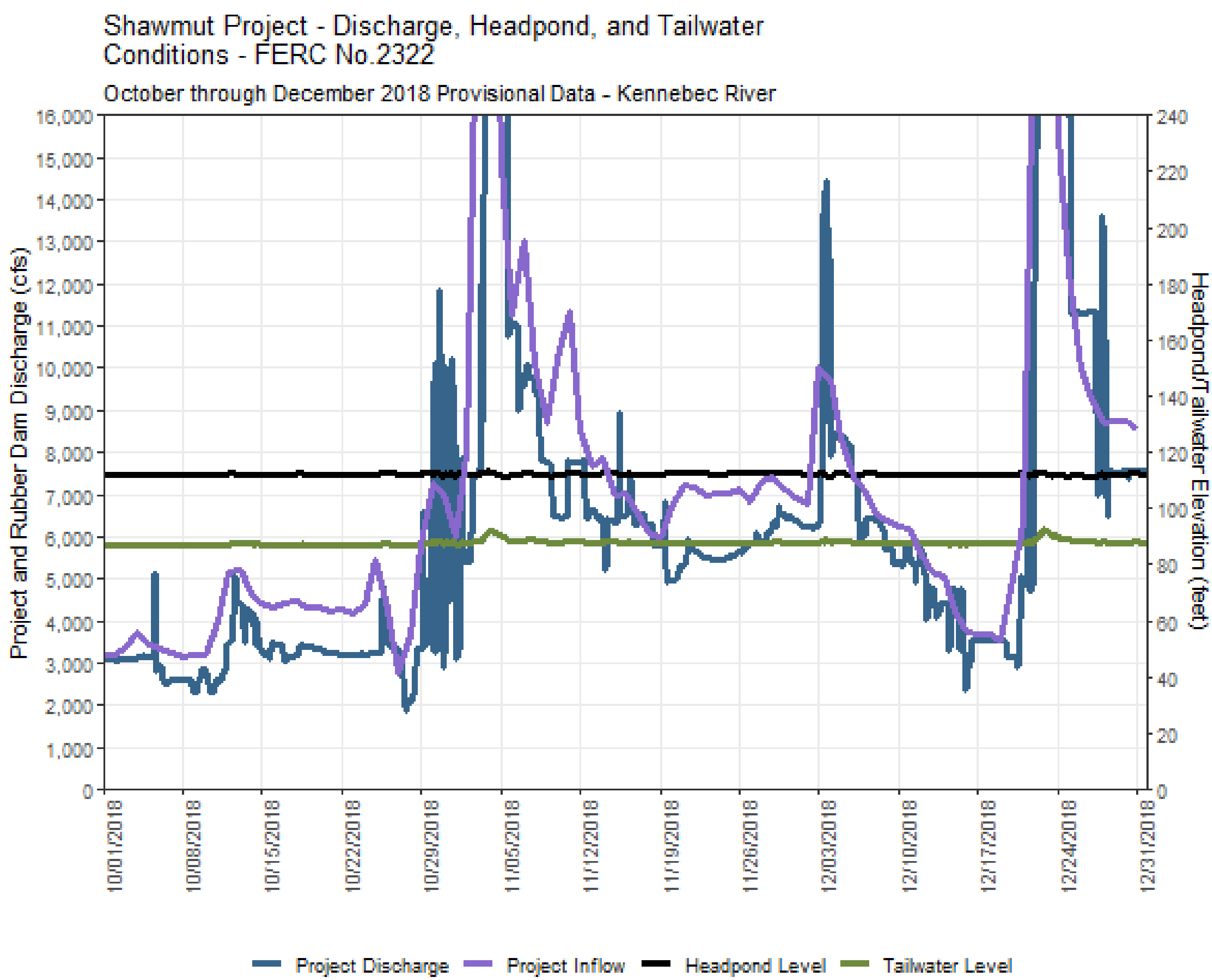
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322
October through December 2018 Provisional Data - Kennebec River
Project and Rubber Dam Discharge (cfs)
Headpond/Tailwater Elevation (feet)
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Project Discharge
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Headpond Level
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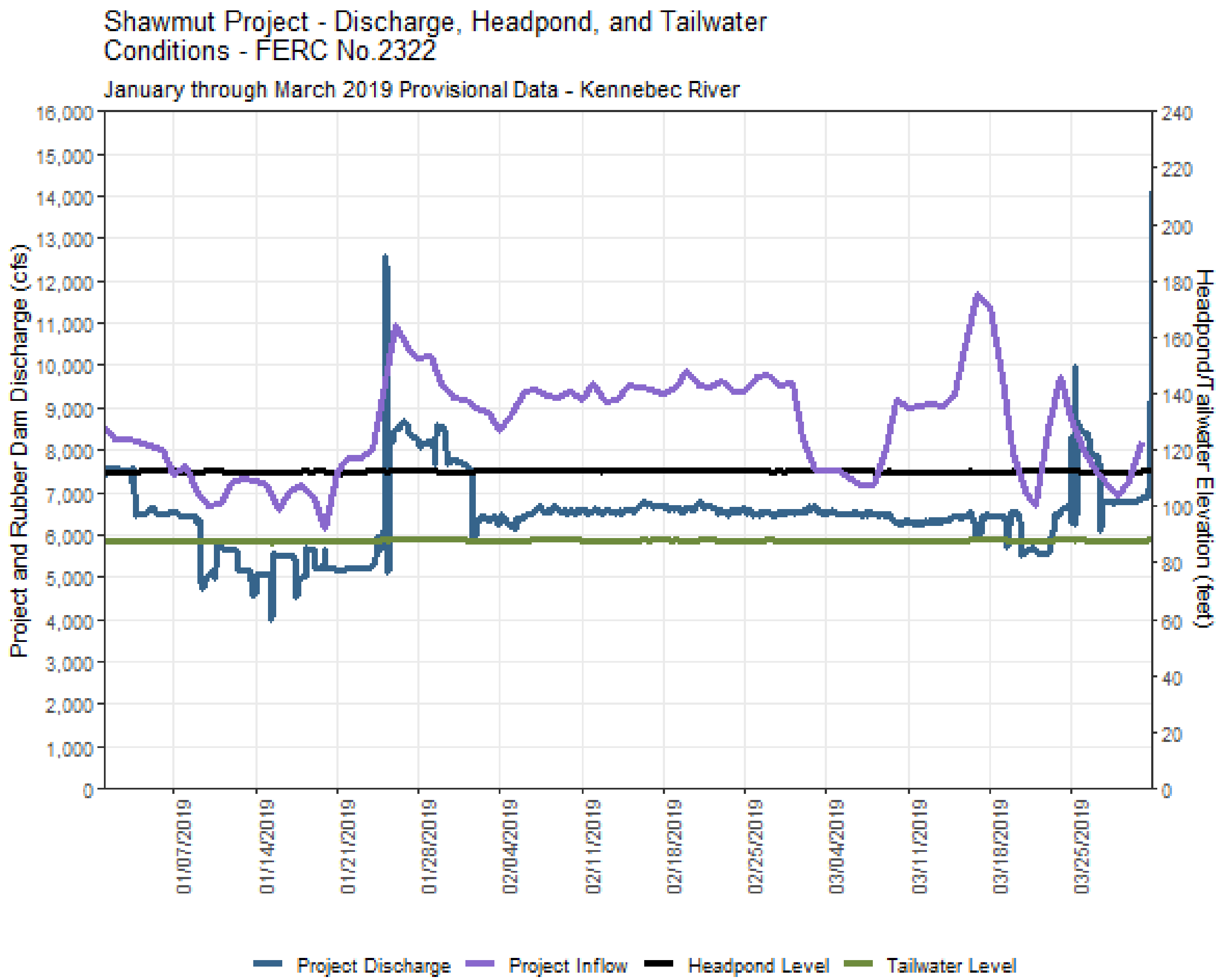

Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322
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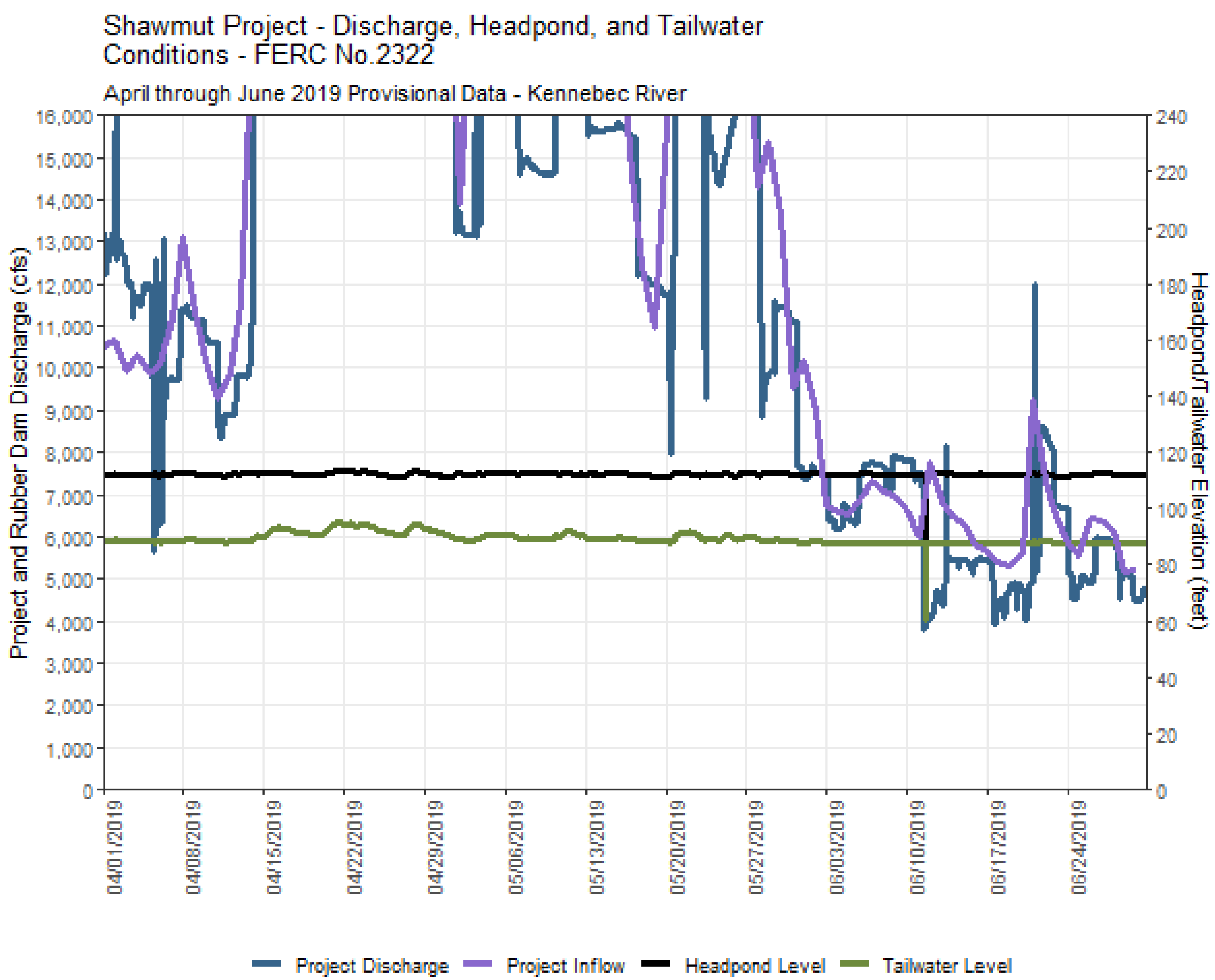
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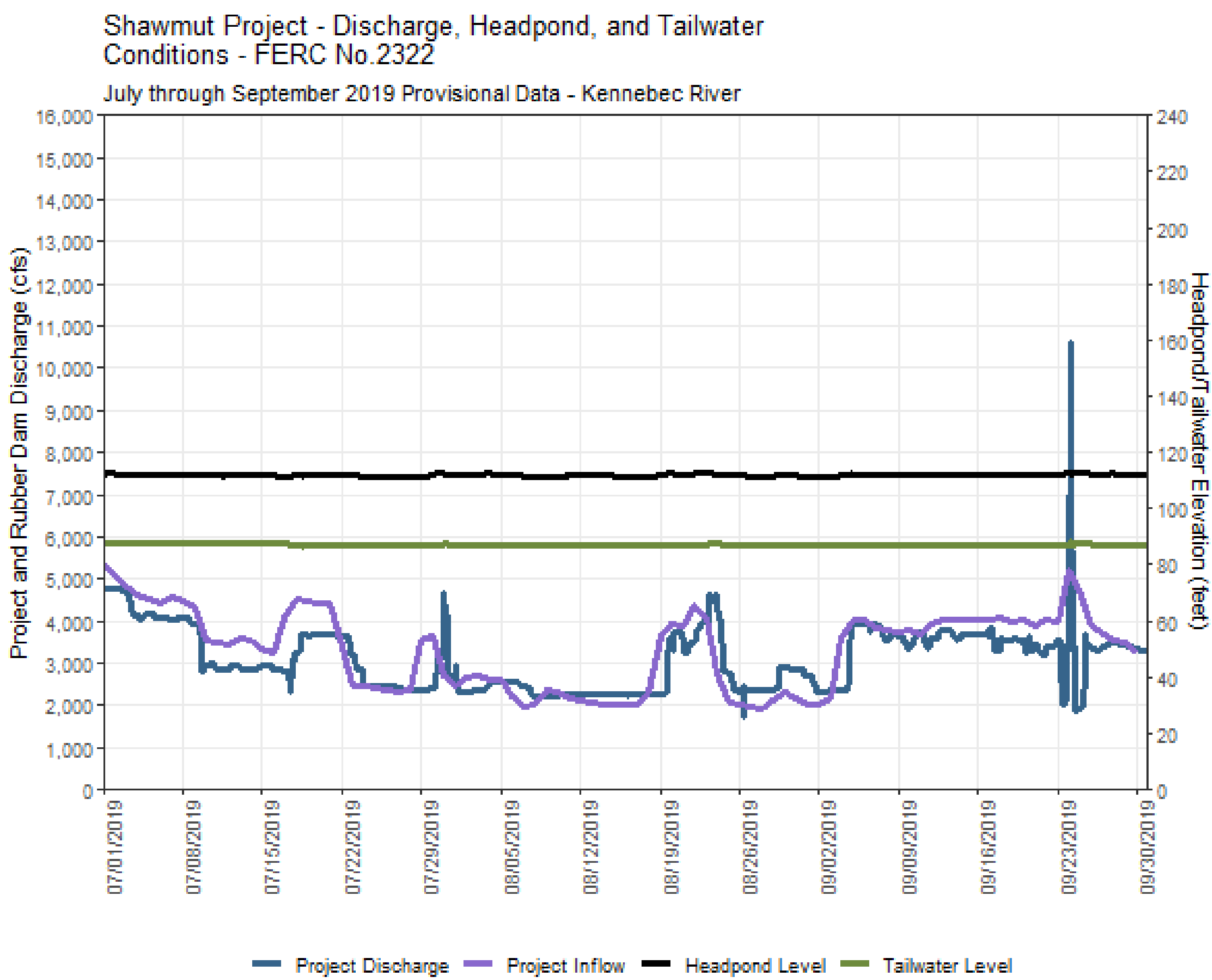

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Project Discharge
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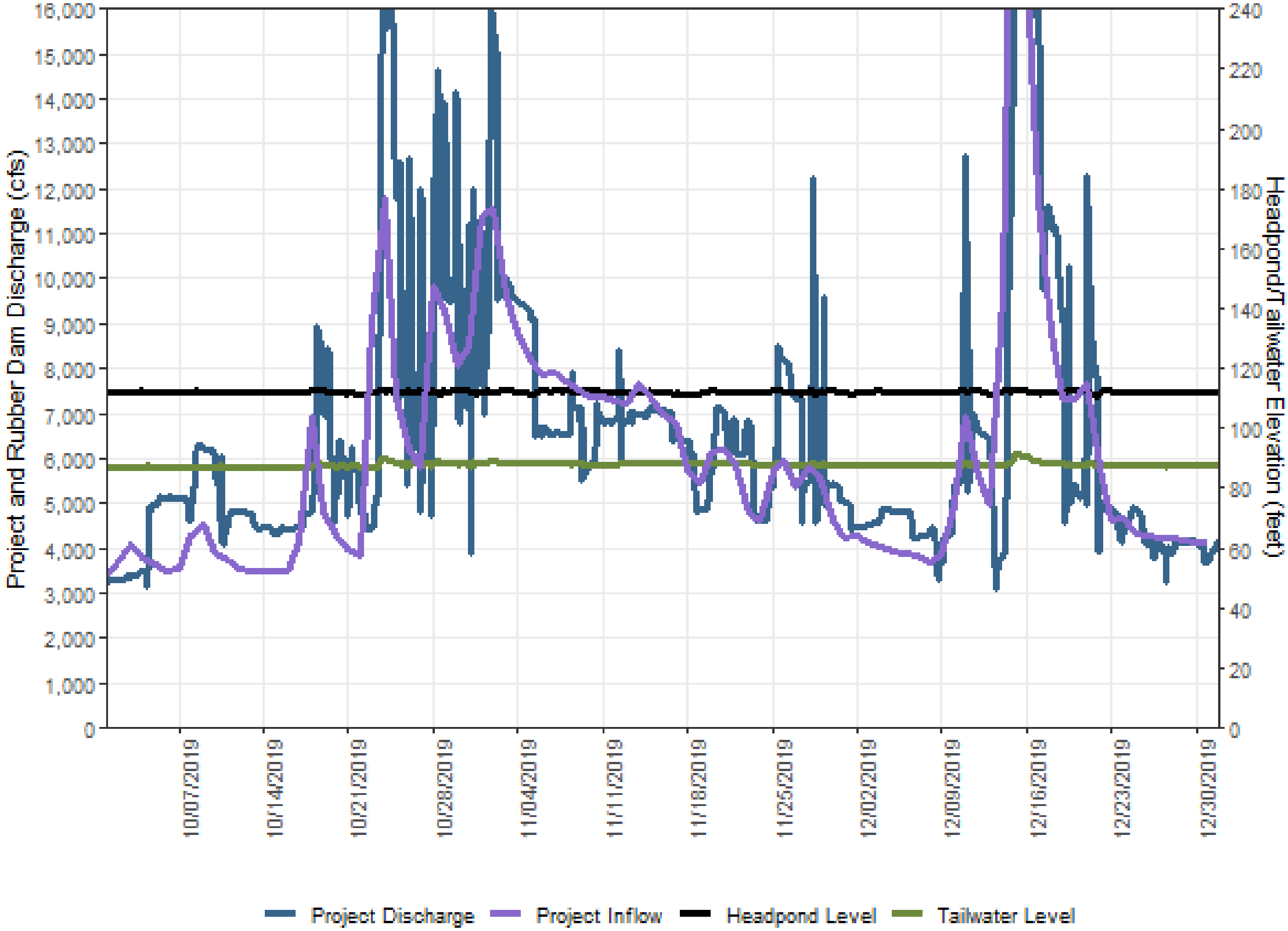
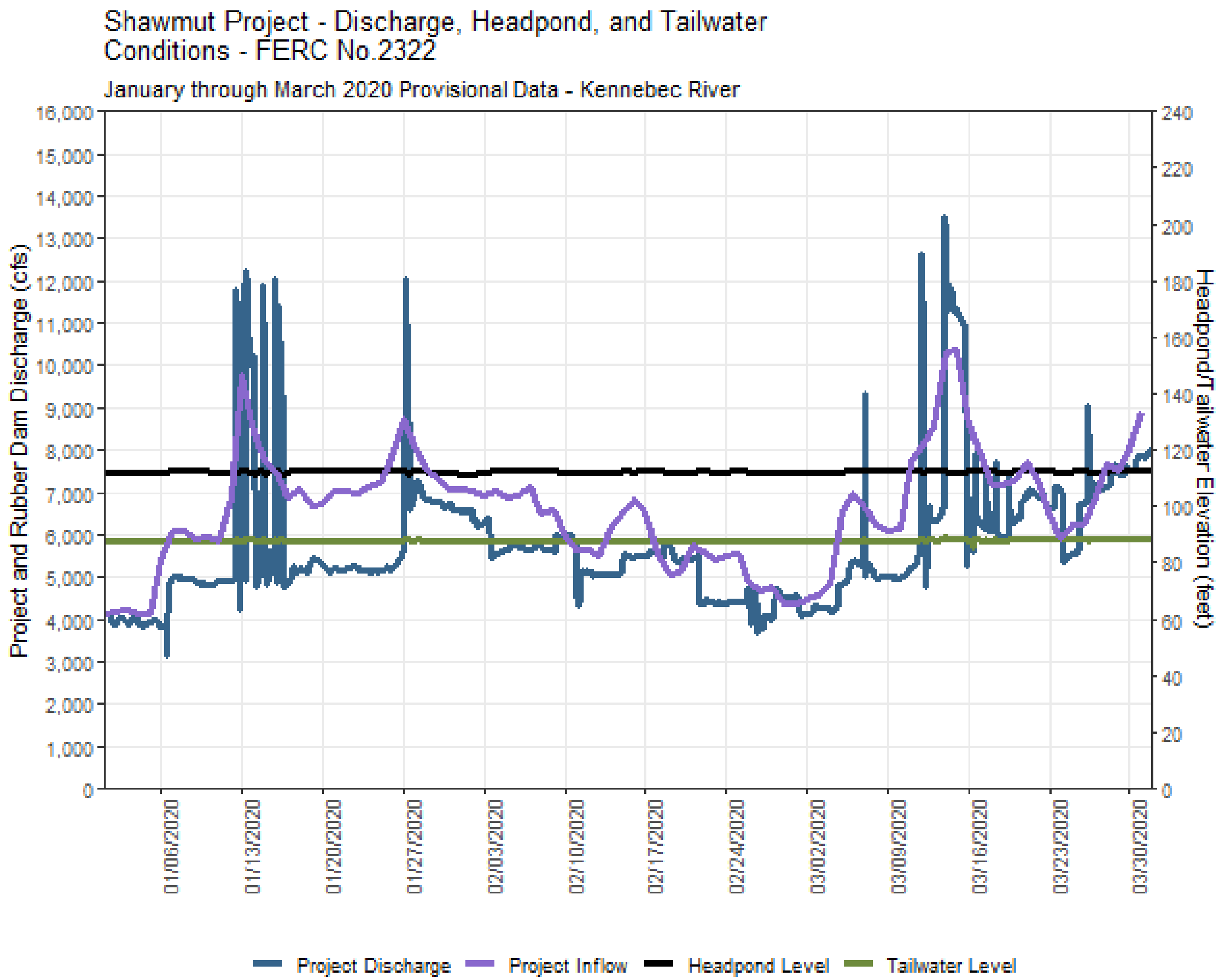
Shawmut Project - Discharge, Headpond, and Tailwater Conditions - FERC No.2322

October through December 2019 Provisional Data - Kennebec River





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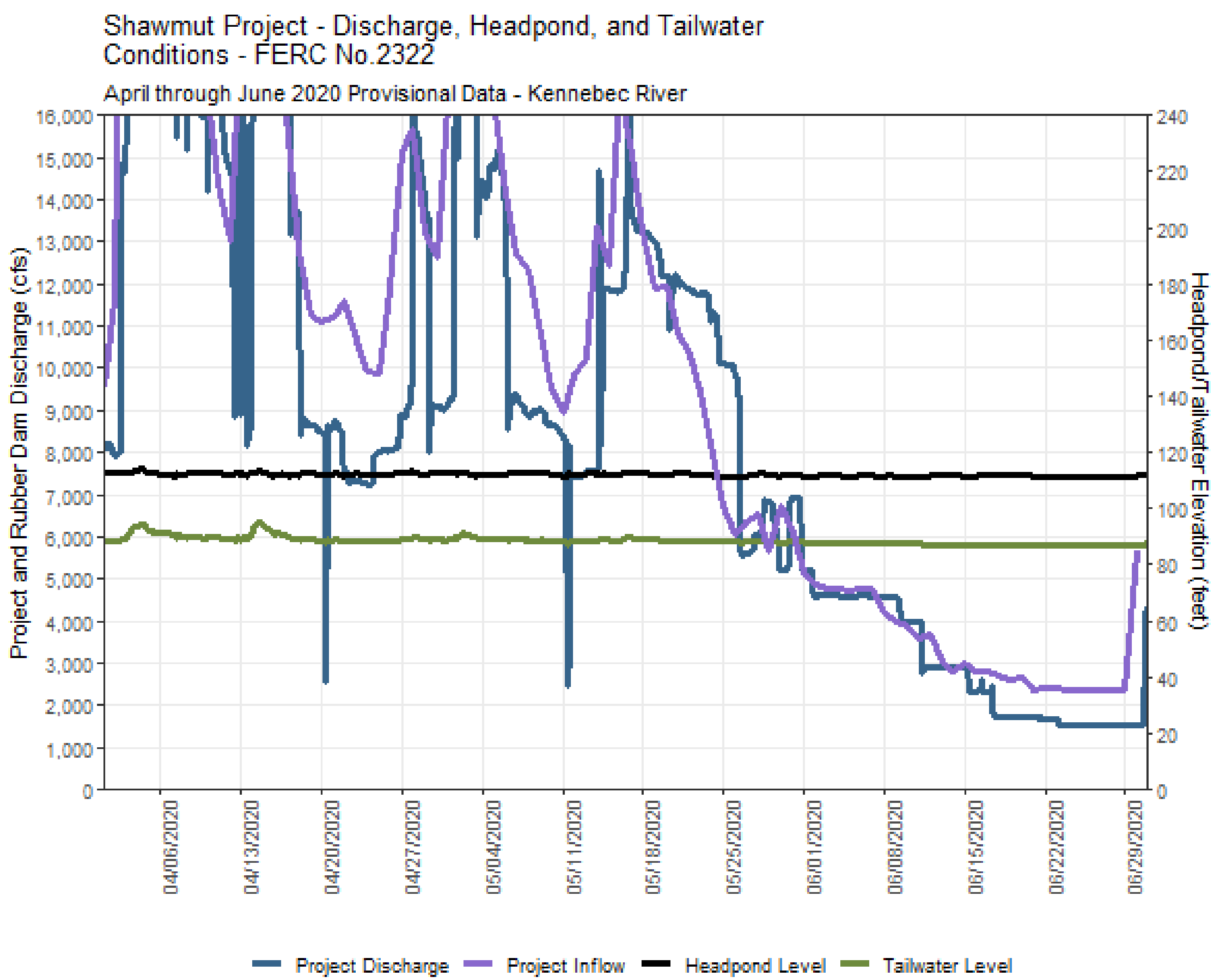
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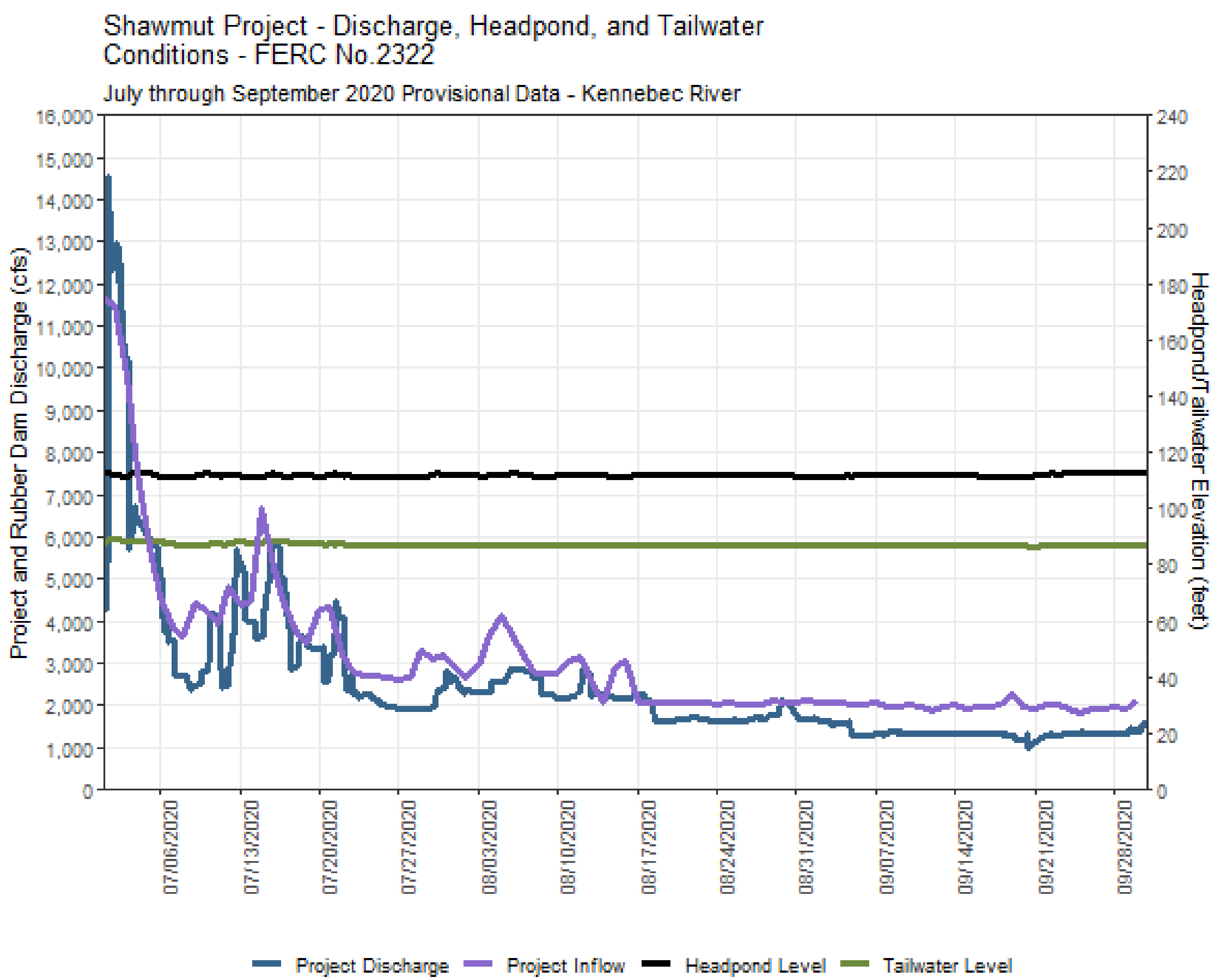

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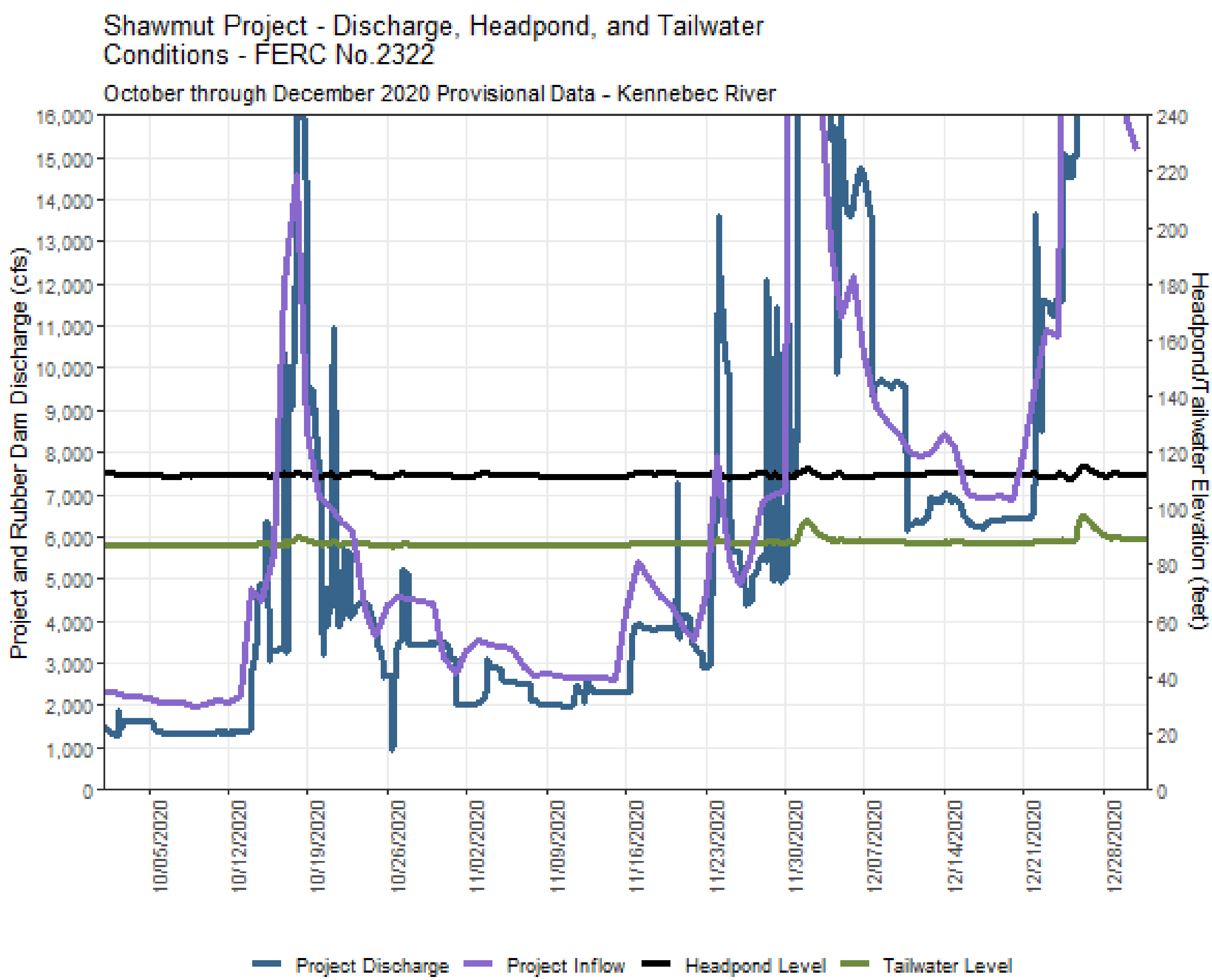
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Project Discharge
Project Inflow
Headpond Level
Tailwater Level

d) Comments and BWPH Responses for Shawmut ISPP

i. BWPH Response to Comments on Shawmut ISPP (October 12, 2021)
ii. MDMR Comments on Shawmut ISPP (September 15, 2021)
iii. USFWS Comments on Shawmut ISPP (September 16, 2021)
iv. Kennebec Coalition and CLF Comments on ISPP (September 20, 2021)

Brookfield
Renewable

October 12, 2021 **Shawmut Project (FERC No. 2322)**

Via E-Filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Brookfield's Responses to Comments Submitted by the Maine Department of Marine Resources, the Kennebec Coalition, and the Conservation Law Foundation Regarding the Interim Species Protection Plan and Draft Biological Assessment for the Shawmut Project (FERC No. 2322)

Dear Secretary Bose,

Brookfield Renewable U.S. ("Brookfield") is the owner and operator of the Shawmut Project, licensed to Brookfield White Pine Hydro LLC ("BWPH") and located on the lower Kennebec River in Maine. On behalf of BWPH, Brookfield submits its responses to the comments submitted to the Federal Energy Regulatory Commission ("FERC) by the Maine Department of Marine Resources ("MDMR"), the Kennebec Coalition, and the Conservation Law Foundation ("CLF") regarding the Interim Species Protection Plan ("ISPP") and Draft Biological Assessment ("Draft BA") for the Shawmut Project.

The Project is located on the lower Kennebec River in Maine in critical habitat for Atlantic salmon, which are listed as federally endangered under the Endangered Species Act ("ESA"). Brookfield operates the Shawmut Project in accordance with the May 12, 2016 FERC Order that requires measures to minimize and monitor any potential incidental take of Atlantic salmon.

The Shawmut Project is currently undergoing relicensing and its current license expires on January 31, 2022. Given the timing of the expiration of the Shawmut Project license, FERC—at the request of federal and state agencies, including MDMR—pushed consideration of Brookfield's proposed measures for long-term protection of Atlantic salmon, including for the construction of upstream fish passage authorized in 2016—into the relicensing process. While working toward relicensing, Brookfield has continued to undertake protection measures for Atlantic salmon, including the implementation of additional measures during the 2021 downstream migration season, at the Shawmut Project.

In light of the agencies' decision to hold off on considering long-term protections for Atlantic salmon, Brookfield filed the ISPP and Draft BA on May 31, 2021. The ISPP seeks to amend the existing license to include actions to avoid and minimize effects to Atlantic salmon for the duration of the license term for the Shawmut Project, while the agencies consider long-term protections during the relicensing process.

By letters to the National Marine Fisheries Service ("NMFS") dated July 9 and July 26, 2021, FERC requested the initiation of formal Section 7 consultation under the ESA (16 U.S.C. § 1536) for, respectively, the Shawmut Project relicensing and the license amendment to incorporate the ISPP for the Shawmut Project while the relicensing is pending. FERC, in its July 26 letter, accepted and requested initiation of consultation on the ISPP and adopted the draft BA for the

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Shawmut ISPP without modification. On August 26, 2021, NMFS issued a letter to FERC, stating "[a]t this time, the information provided lacks sufficient detail or clarity for us to fully assess the effects of the proposed actions on Atlantic salmon, shortnose sturgeon, and Atlantic sturgeon and/or their critical habitat." NMFS included as Attachment A a list of specific requests for clarification and additional information and indicated that it would not initiate consultation until receiving the information. On September 17, 2021, Brookfield submitted supplemental information to proactively address the request for additional information and clarification in the interest of immediate and expedient initiation of Section 7 consultation for the Shawmut relicensing and ISPP.

On August 19, 2021, FERC issued public notice of the Shawmut ISPP and requested comments by September 20, 2021. The following letters providing comment were filed:

- September 14, 2021 – MDMR commented asserting significant impacts to Atlantic salmon from the continued operation of the Shawmut Project.
- September 16, 2021 – USFWS resubmitted its July 16, 2021 comments indicating concern regarding how downstream passage for American eel and alosine are accommodated by the ISPP.
- September 20, 2021 – The Kennebec Coalition and CLF jointly filed a protest in opposition to the ISPP. Among other comments, the Kennebec Coalition and CLF state that the ongoing operations of the Shawmut Project "will jeopardize the survival and recovery of Atlantic salmon" and express concern with achieving the restoration goals for other sea-run species.

MDMR protested the incorporation of the ISPP into the Shawmut Project license and asserted that the ISPP is not sufficiently protective of Atlantic salmon, stating "more can be done to minimize the impacts to endangered salmon." Rather than offer productive solutions to fish passage and protection measures on the Kennebec River, however, MDMR's filing serves only to prolong the license amendment process. MDMR's filing also appears to be an effort to delay restoration of interim take coverage such that, in the meantime, Brookfield may be subject to sanctions or operational limitations that further MDMR's ultimate goal of dam removal.

MDMR also has sought to force the decommissioning and removal of the Shawmut Project through state rulemaking processes, in breach of its contractual obligations in the Kennebec Hydro Developers Group ("KHDG") Settlement Agreement approved by FERC in 1998 ("1998 KHDG Agreement"), and has proposed fish passage requirements that are inconsistent with state law.[1] In addition, MDMR's protest of the ISPP thwarts the overall Shawmut Project relicensing process by delaying incorporation of the ISPP into the existing license while Brookfield is subject to litigation by members of the Kennebec Coalition, who also share MDMR's ultimate objective of forcing a cessation of Shawmut Project operations.[2] As explained more fully herein, the Kennebec Coalition (most members of which are signatories to the KHDG Agreement) and the CLF similarly mischaracterize the measures described in Shawmut's ISPP.

[1] *Brookfield Power US Holding America Corp, et al v. Department of Marine Resources, et al.* (*filed* Sept 27, 2021 Me. Super. Ct.)

[2] *Atlantic Salmon Federation U.S., et al v Brookfield Renewable Partners, L.P., et al*, Case No. 21-cv-00257 (D. Me *filed* Sept 9, 2021)

Expedient initiation of consultation and timely issuance of a Biological Opinion ("BiOp") on the ISPP is necessary to enable FERC to amend the license for the Shawmut Project. Approval of the ISPP will authorize Brookfield to continue with interim protection, mitigation, and enhancement measures until license issuance allows for implementation of permanent upstream and downstream passage measures that will further the long-term viability of Atlantic salmon in compliance with the ESA.

Attached hereto, Brookfield provides responses to specific comments received from USFWS, MDMR, the Kennebec Coalition, and the CLF regarding the Shawmut ISPP and draft BA.

If you have any questions, please feel free to contact me at (207) 755-5606 or kelly.maloney@brookfieldrenewable.com.

Sincerely,

Kelly Maloney
Manager, Compliance – Northeast

Attachments: Response to Agency and NGO Comments on the Shawmut ISPP and BA

Cc: N. Stevens, J. Seyfried, S. Michaud, J. Rancourt, D. Watson, R. Dorman, M. Kessel; BWPH

BWPH File: 2322|01

USFWS Comments on the Shawmut ISPP/BA

Comment	Page #	Brookfield's Response
In particular, the Service is concerned about BWPH's proposal to implement a floating guidance boom at…Shawmut…the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects…are protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines.	2	Downstream passage facilities and operations at the Shawmut Project is a requirement of the existing license pursuant to FERC's September 16, 1998 Order Amending License incorporating the terms of the 1998 Kennebec Hydro Developer's Group (KHDG) Settlement Agreement ("1998 KHDG Agreement"), of which USFWS is a signatory, and the May 12, 2016 FERC Order. For Atlantic salmon, whole station survival at Shawmut is relatively high with a three-year average of 93.6%. BWPH has subsequently implemented supplemental spill of 560 cfs during the downstream smolt migration. Downstream radio telemetry studies for eels were conducted collaboratively with and funded by MDMR at the lower Kennebec Projects but were discontinued due to a lack of the availability of silver eels (see 2004 Diadromous Fish Passage Efforts Report filed on April 1, 2005). Shawmut had a whole station survival for eels of 71.1% (2007) and 85.7% (2008), the latter of which included the night-time shut-down of Units 7 and 8. USFWS is an intervenor in the Shawmut Project relicensing process, and has preliminarily prescribed night-time shut-downs specifically for downstream eel passage. Further, USFWS is aware that NMFS has preliminarily prescribed 1 to 1.5-inch clear spaced trashracks or overlays for both powerhouses for all migratory species.

		Finally, Brookfield has fully accommodated anadromous species in the upstream fish passage designs for Shawmut, following both USFWS design criteria as well as MDMR's recommendations for design populations. And the fishway has been designed in full consultation with all fisheries agencies, including USFWS.

MDMR Comments on the Shawmut ISPP/BA

Comment	Page #	Brookfield's Response
MDMR protests the Application to incorporate Interim Species Protection Plan (ISPP) into the Shawmut Project License. Considering that the initial meeting was held on June 12, 2018, the Licensee had ample time to consult with the resource agencies and develop a Species Protection Plan for the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects that was supported by the resource agencies. We strongly protest what amounts to the extension of the expired Interim Species Protection Plan (ISPP) that is not sufficiently protective of endangered Atlantic Salmon. We strongly protest the incorporation of this ISPP that has minimal protection for five species of diadromous fishes, which are a component of designated critical habitat in the Project area.	1,2	Brookfield held 10 meetings from June 12, 2018 to May 1, 2019 with the resource agencies, including MDMR, to discuss and develop the December 31, 2019 SPP, as well as additional meetings with NMFS and MDMR to continue to discuss their comments on the draft SPP which was submitted in June 2019 for agency review and comment FERC's July 13, 2020 letter regarding the previously filed SPP instructed Brookfield to reconvene with NMFS and USFWS to revise the SPP as an ISPP and refile by May 31, 2022, which Brookfield accomplished one year early (on May 31, 2021). The ISPP and draft BA were accepted by FERC without modification and submitted to NMFS to initiate Section 7 consultation by letter dated July 26, 2021. As MDMR is aware, the Shawmut Project is currently undergoing relicensing; the current Shawmut Project license expires on January 31, 2022. In the interim period, Brookfield intends to continue the protective measures already incorporated into its license pursuant to the May 19, 2016 FERC Order Amending License incorporating the 2013 ISPP for the Lower Kennebec Projects.

Comment	Page #	Brookfield's Response
		Upstream passage for diadromous species is accomplished via the Lockwood lift (i.e. there are no upstream migrating fish within Shawmut Project waters). Downstream passage studies conducted to date indicate that Shawmut is anticipated to exceed a 95% whole station survival (with the provision of supplemental flow via the hinge boards). Downstream eel telemetry studies (2007 and 2008) indicate a whole station survival of 71.1% and 85.7%, respectively, the latter of which includes Unit 7 and 8 night-time shut-downs which are currently implemented at the Project.

Comment	Page #	Brookfield's Response
Many aspects of impacts to Atlantic salmon were not contemplated in the original ISPP, including take coverage for the smolt stocking program that began in 2020 and new information regarding the environmental baseline and impacts of the projects. The licensee voluntarily shut the Shawmut Project down for a period in the spring of 2021 as a protective measure, but has not incorporated a shutdown measure in the ISPP, demonstrating that more can be done to minimize the impacts to endangered salmon.	2	Atlantic salmon smolt stocking efforts are conducted by MDMR below the Lockwood Project. These stocking efforts do not have any relation to the Shawmut Project and would not be a component of the Shawmut ISPP. Brookfield currently provides downstream passage for all anadromous species, including Atlantic salmon, from April 1 through December 31 via the sluice gate and Tainter gate at Shawmut. Specific to Atlantic salmon smolt, Brookfield has voluntarily provided additional spill of 560 cfs by dropping four hinge flashboards from April 1 through June 15 to augment downstream passage. The voluntary shutdown of the Shawmut Project in 2021 was in response to NMFS' recommendation that Brookfield take reasonable precautions during the pendency of Brookfield's application for incidental take coverage. The Shawmut ISPP is intended to be a short term undertaking until a new license (including the FERC Staff Recommended Measures with Mandatory Conditions) is issued.

Comment	Page #	Brookfield's Response
By letter dated August 26, 2021, the National Marine Fisheries Service (NMFS) informed the Commission that formal section 7 consultation under the ESA has not been initiated for 1) the proposed relicensing of the Shawmut Hydroelectric Project (P-2322-069); 2) a proposed license amendment to incorporate an Interim Species Protection Plan (ISPP or Interim Plan) for the Shawmut Project (P-2322-071); and 3) a proposed license amendments to incorporate a Final SPP (Final Plan) for the Lockwood, Hydro-Kennebec and Weston Projects. NMFS has found the application for consultation to be incomplete and has requested additional information.	2	NMFS' August 26, 2021 letter contained requests for minor clarifications on the downstream fish passage operating season and construction details for the Lockwood and Weston upstream fish passage facilities. On September 16, 2021, Brookfield filed supplemental information and clarifications into the dockets for the Lower Kennebec SPP and Shawmut ISPP in response to NMFS' requests.
The actions proposed in the ISPP for the Shawmut Project and the SPP for the Lockwood, Hydro Kennebec, Shawmut, and Weston projects have not been analyzed and a Biological Opinion has not been issued by NMFS. The ISPP cannot be incorporated into the Shawmut License without these legal steps being taken.	2	The actions proposed in the ISPP for the Shawmut Project and the SPP for the Lockwood, Hydro Kennebec, and Weston Projects are currently being analyzed through the agencies' consultation process. NMFS' August 26, 2021 letter was specifically written in response to FERC's July 26, 2021 letter requesting NMFS engage in formal consultation on Lower Kennebec SPP and Shawmut ISPP and proposing adoption of the Biological Assessments without modification.

Kennebec Coalition and CLF – Comments on the Shawmut ISPP/BA

Comment	Page #	Brookfield's Response
The present application requests Commission approval to amend the license to incorporate an ISPP, which expired on December 31, 2019… the present application requests the Commission approve an expired ISPP, which had been entered by this Commission in reliance on a now-expired 2013 Biological Opinion, following a requested one-year extension by the licensee to the overall license term.	7, 9	This comment misconstrues the action before FERC. Brookfield is seeking FERC approval to incorporate an ISPP filed on May 31, 2021, into the Shawmut license. Brookfield previously had requested on July 29, 2020 (with a BA submitted on February 1, 2021) to extend the 2013 ISPPs for the lower Kennebec River Projects, following FERC's instruction to reconvene consultation on the SPP for the Lockwood, Hydro Kennebec and Weston Projects and declaration of their intent to consider fish passage measures for the Shawmut Project as part of relicensing by letters dated July 13, 2021. On August 5, 2020, FERC issued a public notice of application to amend the project licenses to extend the expiration of the 2013 ISPPs. Correspondence between NMFS, Brookfield and FERC between September 4, 2020 and May 18, 2021 culminated in the determination to consult on the timely submittal of a new SPP for the Lockwood, Hydro Kennebec and Weston Projects (ahead of the May 2022 deadline), an ISPP for the remaining term of the Shawmut license, and the Final License Application ("FLA") for Shawmut. On May 31, 2021, Brookfield filed a new ISPP and BA for Shawmut, which proposed a continuation of existing protection measures plus additional voluntary enhancements for Atlantic salmon passage to be implemented through the issuance of a new license for the Project.

Comment	Page #	Brookfield's Response
Brookfield still has not submitted a compliant and sufficient Final Plan for the Shawmut Project. This is exemplified by the NMFS correspondence to this Commission of August 25, 2021, noting the deficiencies in even the current request to extend the expired ISPP terms to the remaining life of the Shawmut license	8	This statement is untrue. The Final License Application and 2019 Biological Assessment constituted the "Final Plan for the Shawmut Project" by virtue of FERC's determination on July 13, 2020, to pull the previously authorized and proposed fish passage measures at the Project into relicensing. On July 9, 2021, FERC requested NMFS engage in formal Section 7 consultation on the Shawmut relicensing, indicating that FERC's July 1, 2021 Draft Environmental Assessment ("DEA") "serves as our biological assessment and EFH assessment". On July 26, 2021, FERC requested NMFS engage in formal consultation on the Shawmut ISPP and proposed adopting the Biological Assessment without modification. On August 26, 2021, NMFS filed a request for additional information and clarification necessary for completing Section 7 consultation comprehensively for the four Lower Kennebec Projects. On September 17, 2021, Brookfield filed supplemental information in response to NMFS' August 26, 2021 request for additional information and clarification, which generally consisted of: • Clarification of the operational dates and proposals for the Shawmut and Weston downstream fish passage facilities; • Construction effects and schedule information inherent to the US Army Corps of Engineers permits; and • Number of smolts intended for proposed studies.

Comment	Page #	Brookfield's Response
Commission must hold any decision on the present application in abeyance, pending formal section 7 review and approval by NMFS under the ESA, because–to be candid–there are serious issues posed on whether the ongoing operations of the Shawmut Project for the remaining term of its license to January 31,2022, jeopardize the survival and recovery of Atlantic salmon. And this is true even if terms of the ISPP were incorporated into the license, because those terms are now over 8 years old, expired, and have been placed in issue by NMFS in the context of an upcoming formal consultation under section 7.		By letters dated July 9 and July 26, 2021, FERC requested NMFS engage in formal Section 7 consultation on the Shawmut relicensing and the Shawmut ISPP, respectively. Brookfield has no expectation that FERC intends to act on the request to amend the Shawmut project license to incorporate the ISPP measures without completing Section 7 consultation. In the interim timeframe until issuance of a new license, no upstream passage for migrating adult will be present at the Project because all upstream migrating adults are collected at the Lockwood fish lift and trucked by MDMR. Downstream passage facilities also currently exist for both Atlantic salmon smolt and kelt. The SPP proposes and the BA analyzes additional supplemental measures to improve passage conditions. Brookfield is not requesting an extension of the 2013 ISPP but would continue those existing measures of the 2013 ISPP that are required by the existing license. Brookfield is also proposing additional supplemental measures such as extended operational periods and supplemental spill not previously contemplated in NMFS'2013 Biological Opinion.

Comment	Page #	Brookfield's Response
Included in the attached protest and objections is the Kennebec Coalition and CLF demand that this Commission order the preparation of an environmental impact statement in accordance with the Commission's responsibilities and the procedural mandates of the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 et seq. The present request also triggers the requirement of NEPA scrutiny.	10	The September 16, 1998 FERC license amendments that incorporated the terms of the 1998 KHDG Agreement (to which most Kennebec Coalition members are signatories) authorize new fish passage at Shawmut (as well as at Lockwood, Hydro-Kennebec and Weston). In fact, FERC previously conducted a NEPA review on this proposed action: the 1997 Environmental Impact Statement for the Lower Kennebec Basin (FERC/FEIS-0097). The current amendment does not propose the fishway, which already had been approved, and FERC further analyzed the fishway under the Shawmut Project relicensing in its July 2, 2021 DEA. The ISPP amendment request includes operation of the existing downstream fishways, plus supplemental measures, for the duration of the license. As such, the amendment does not include "additional project works" and is not an action that requires a NEPA review, per FERC's regulations at 18 CFR 380.5 and 380.6.

Comment	Page #	Brookfield's Response
The Shawmut Project is positioned to block the outmigration of Atlantic salmon kelts during the upcoming fall season downstream migration. The Shawmut Project currently has no valid incidental take statement or incidental take authorization under the ESA. Far greater measures than those set forth in an expired interim plan that is now more than eight years old are required to avoid any "take" of salmon at the Shawmut Project during downstream migrations. Indeed, at the present time, without any "take" authorization under the ESA, after years of delay following take permit expiration, any and all operations at the Shawmut Project that are reasonably likely to result in "take" during the fall outmigration season (October 15 through December 31) must cease.	10	The effects of continued operation of the Shawmut Project, as well as existing downstream fishways and enhancement measures (including extended downstream operation periods to accommodate outmigrating kelt) are analyzed in the May 31, 2021 BA. The May 31, 2021 ISPP and BA were submitted specifically to address incidental take coverage. Brookfield is proposing those measures recommended by the agencies as appropriate to minimize potential incidental take while the consultation process concludes.
It is necessary for the Commission to consider these other projects, because any NEPA analysis requires this cumulative consideration in relation to Shawmut operations adversely affecting the environment.	11	FERC conducts NEPA reviews for relicensing as a matter of course and had previously announced its intention to undertake a NEPA review of the Shawmut relicensing in Scoping Document 1, issued November 20, 2015. Continuing operations is not an action requiring NEPA review per FERC's regulations.
In addition, the ESA analysis includes the issues of how delayed mortality resulting from the Shawmut Project factors into overall delayed mortality during migrations, and thus factors into the jeopardy analysis under the ESA	11	The two most significant factors contributing to delayed mortality (i.e., injury and passage delay) are addressed by the downstream passage measures proposed in the Shawmut FLA.

Comment	Page #	Brookfield's Response
Brookfield promised this Commission that the Shawmut Project would be considered as part of a comprehensive four project analysis, and its continuing operations for the remaining life of its license should not be arbitrarily segregated from the comprehensive problem posed by the barrier and impediments of all four hydropower projects on the lower mainstem of the Kennebec River.	11	Brookfield submitted a comprehensive four Project SPP and BA to FERC in December 2019. FERC, in direct response to requests by the agencies and the Kennebec Coalition themselves, segregated the consideration of passage measures for Shawmut to be completed pursuant to the Shawmut relicensing proceeding.
Lastly, this Commission should order that Brookfield's unilateral withdrawal of its water quality certification application at the Shawmut Project, under section 401 of the Clean Water Act – when that unilateral withdrawal occurred in the face of the MDEP draft order to deny water quality certification – should independently require section 7 formal consultation by the Commission in order to be allowed. The withdrawal potentially not only adds an additional year to the relicensing process, it has ramifications suggesting that the current water quality certification under the current not-yet-expired license of the Shawmut Project, requires re-examination.	11	Brookfield's state water quality certification under Section 401 of the Clean Water Act is irrelevant to and entirely separate from the limited matters under consideration by FERC in the ISPP. A licensee's withdrawal of a state water quality certification application is not a federal action triggering consultation under section 7 of the ESA.

STATE OF MAINE
DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

JANET T. MILLS
GOVERNOR

PATRICK C. KELIHER
COMMISSIONER

September 14, 2021

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

RE: NOTICE OF AMENDMENT APPLICATION TO INCORPORATE INTERIM SPECIES PROTECTION PLAN INTO THE PROJECT LICENSE AND SOLICITING COMMENTS, MOTIONS TO INTERVENE, AND PROTESTS
Shawmut Hydroelectric Project (P-2322-071)

Dear Secretary Bose:

On August 19, 2021, the Commission issued a *Notice Of Amendment Application To Incorporate Interim Species Protection Plan Into The Project License And Soliciting Comments, Motions To Intervene, And Protests* for the Shawmut Project located on the Lower Kennebec River in Kennebec and Somerset Counties, Maine.

Motion to Intervene

By this letter we provide notice pursuant to 18 C.F.R. §385.214(a), as amended, that our Agency is requesting intervenor status in this proceeding. Under Maine State Law (12 MRSA, §6021), the Maine Department of Marine Resources (MDMR) mandate is "*...conserve and develop marine and estuarine resources; to conduct and sponsor scientific research; to promote and develop the Maine coastal fishing industries; to advise and cooperate with local, state and federal officials concerning activities in coastal waters; and to implement, administer and enforce the laws and regulations necessary for these enumerated purposes, as well as the exercise of all authority conferred by this Part.*" Intervenor status will provide opportunity for participation.

MDMR protests the Application to incorporate Interim Species Protection Plan (ISPP) into the Shawmut Project License.

Considering that the initial meeting was held on June 12, 2018, the Licensee had ample time to consult with the resource agencies and develop a Species Protection Plan for the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects that was supported by the resources agencies. We strongly protest what

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amounts to the extension of the expired Interim Species Protection Plan (ISPP) that is not sufficiently protective of endangered Atlantic Salmon. We strongly protest the incorporation of this ISPP that has minimal protection for five species of diadromous fishes, which are a component of designated critical habitat in the Project area.

Many aspects of impacts to Atlantic salmon were not contemplated in the original ISPP, including take coverage for the smolt stocking program that began in 2020 and new information regarding the environmental baseline and impacts of the projects. The licensee voluntarily shut the Shawmut Project down for a period in the spring of 2021 as a protective measure, but has not incorporated a shutdown measure in the ISPP, demonstrating that more can be done to minimize the impacts to endangered salmon.

By letter dated August 26, 2021, the National Marine Fisheries Service (NMFS) informed the Commission that formal section 7 consultation under the Endangered Species Act (ESA) has not been initiated for 1) the proposed relicensing of the Shawmut Hydroelectric Project (P-2322-069); 2) a proposed license amendment to incorporate an Interim Species Protection Plan (ISPP or Interim Plan) for the Shawmut Project (P-2322-071); and 3) a proposed license amendments to incorporate a Final SPP (Final Plan) for the Lockwood, Hydro-Kennebec and Weston Projects. NMFS has found the application for consultation to be incomplete, and has requested additional information. On September 9, 2021, the Licensee was subject to a COMPLAINT FOR VIOLATION OF THE ENDANGERED SPECIES ACT, 16 U.S.C. §§ 1531, et seq., INCLUDING DECLARATORY JUDGMENT AND INJUNCTIVE RELIEF filed in the United States District Court for the District of Maine. Incorporating the ISPP terms into the existing license may then subject that action to this litigation.

The actions proposed in the ISPP for the Shawmut Project and the SPP for the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects have not been analyzed and a Biological Opinion has not been issued by NMFS. The ISPP cannot be incorporated into the Shawmut License without these legal steps being taken.

Please contact Gail Wippelhauser at gail.wippelhauser@maine.gov or at 207-904-7962 if you have any questions.

Sincerely,

Patrick C. Keliher, Commissioner

cc: Sean Ledwin, Paul Christman, MDMR
John Perry, Jason Seiders MDIFW
Kathy Howatt, Chris Sferra, MDEP
Peter Lamothe, Julianne Rosset, Bryan Sojkowski, USFWS
Julie Crocker, Matt Buhyoff, Dan Tierney, Don Dow, NOAA

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Document Content(s)

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
5 Post Office Square, Suite 18011
Boston, Massachusetts 02109

September 16, 2021

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ER 21/0349

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E
Washington, DC 20426

RE: COMMENTS
Application for Amendment of License
Shawmut Hydroelectric Project, FERC No. 2322-071
Kennebec River, Kennebec and Somerset Counties, Maine

Dear Secretary Bose:

The U.S. Department of the Interior (Department) has reviewed the August 19, 2021, *Notice of Amendment Application to Incorporate Interim Species Protection Plan into the Project License and Soliciting Comments, Motions to Intervene, and Protests* for the Shawmut Hydroelectric Project, located on the Kennebec River, Maine. The Licensee, Brookfield White Pine Hydro, LLC requests approval to amend the license for the project to incorporate the provisions of an Interim Species Protection Plan for Atlantic salmon.

On July 22, 2021, the Department's United States Fish and Wildlife Service submitted comments on Brookfield White Pine Hydro, LLC's 2021 Interim Species Protection Plan for the Shawmut Project (Attachment A) and the Species Protection Plans for the Lockwood (FERC No. 2574), Hydro-Kennebec (FERC No. 2611), and Weston (FERC No. 2325) Hydroelectric Projects.[1]

[1] Accession No. 20210722-5181

Thank you for the opportunity to review and comment on this Amendment Application. If you have questions regarding these comments, please contact Julianne Rosset at julianne_rosset@fws.gov. Please contact me at (617) 223-8565 if I can be of further assistance.

Sincerely,

ANDREW RADDANT Digitally signed by ANDREW RADDANT Date: 2021.09.15 14:53:56 -04'00'

Andrew L. Raddant
Regional Environmental Officer

Attachment

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Maine-New Hampshire Fish and Wildlife Service Complex
Ecological Services
Maine Field Office
P.O. Box A
306 Hatchery Road
East Orland, Maine 04431
207/469-7300 Fax: 207/902-1588

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E
Washington, DC 20426

July 16, 2021

RE: Comments on Brookfield White Pine Hydro, LLC's 2021 Species Protection Plans at the Lockwood (FERC No. 2574), Hydro-Kennebec (FERC No. 2611), Weston (FERC No. 2325), and Shawmut (FERC No. 2322) Hydroelectric Projects

Dear Secretary Bose:

The United States Fish and Wildlife Service (Service) is in receipt of Brookfield White Pine Hydro, LLC's (BWPH; Licensee) Lower Kennebec River Species Protection Plan (SPP) and Draft Biological Assessment (BA) for the Lockwood (FERC No. 2574), Hydro-Kennebec (FERC No. 2611), and Weston (FERC No. 2325) projects as well as the Interim Species Protection Plan (ISPP) for Shawmut (FERC No. 2322) which were submitted to the Federal Energy Regulatory Commission (Commission) on May 31, 2021.[1,2] The Service has reviewed the SPP, BA, and ISPP, as well as other relevant documents in our administrative record, and offers the following comments.

BACKGROUND

In May of 2021, BWPH held four virtual meetings with the Service and the National Marine Fisheries Service (NMFS) prior to submitting the SPP, BA, and ISPP to the Commission.[3] The purpose of each meeting was to discuss interim protective measures for Atlantic salmon (*Salmo salar*) as well as BWPH's plan for revising the comprehensive SPP for the Lockwood, Hydro-

[1] Accession No. 20210601-5152
[2] Accession No. 20210601-5149
[3] Meetings occurred on May 6th, May 13th, May 20th, and May 26th, 2021.

Kennebec, and Weston projects per the conversation that took place on April 8, 2021 between the Commission, BWPH, and NMFS.[4]

During the May discussions, the Service asked BWPH how other species were being considered during the development of the SPP. While the Service understand the SPP and BA's purpose are to outline the proposed actions the Licensee will undertake to protect Atlantic salmon, Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), and shortnose sturgeon (*Acipenser brevirostrum*), the Kennebec River contains a number of other species like American eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), collectively referred to as river herring, sea lamprey (*Petromyzon marinus*), and American shad (*Alosa sapidissima*). In particular, the Service is concerned about BWPH's proposal to implement a floating guidance boom at Lockwood, Hydro Kennebec, Weston, and potentially Shawmut. BWPH stated that the floating guidance boom has been tested, and has been proven effective at, protecting alewife, blueback herring, American shad (collectively referred to as alosines), and eel; citing a 2015 river herring study and a 2008 eel study at Lockwood.

COMMENTS

The 2015 *Evaluation of Downstream Passage for Adult and Juvenile River Herring* demonstrated that 53 percent of the study fish went through the Lockwood turbines, rather than being guided by the boom to the downstream bypass, and survival was lowest for those fish passing Lockwood via the units (i.e., 77-4-81.7 percent survival).[5] Additionally, the 2008 eel study was performed prior to the 2009 installation of the floating guidance boom at Lockwood.[6,7] The Service does not know of any studies that have assessed how effective floating guidance booms are at protecting eels as they attempt to migrate downstream past a hydroelectric project. However, we do know that eels are a bottom-oriented species (Brown et al. 2009) and therefore a floating guidance boom with partial depth panels would not be fully protective. As stated in our 2019 Fish Passage Engineering Design Criteria manual, "A floating guidance system for downstream fish passage is constructed as a series of partial depth panels or screens anchored across a river channel, reservoir, or power canal. These structures are designed for pelagic fish which commonly approach the guidance system near the upper levels of the water column. While full-depth guidance systems are strongly preferred, partial-depth guidance systems may be acceptable at some sites (e.g., for protection of salmonids, but not eels)." Booms have not been implemented as a protective measure for eels or alosines anywhere else in our region, which spans fourteen states, unless they are installed with other protective measures that are suitable to ensure the safe, timely, and effective downstream passage of our trust species (e.g., inclined bar screens, angled bar racks, etc.). Therefore, the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects, as part of the current SPP process, are protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines.

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[4] Accession No. 20210422-3005

[5] Accession No. 20160331-5144

[6] Accession No. 20080605-5027

[7] In a March 31, 2016 Diadromous Fish Passage Report for the Lower Kennebec River Watershed BWPH states, "…following an agency consultation process, a new floating fish guidance boom and associated new surface gate were installed at the Lockwood Project in 2009 to provide downstream passage for Atlantic salmon, river herring and American shad adults and juveniles."

Thank you for this opportunity to comment. If you have any questions, please contact Julianne Rosset of this office at julianne_rosset@fws.gov.

Sincerely,

Peter Lamothe Digitally signed by Peter Lamothe Date: 2021.07.21 12:09:19 -04'00'

Peter Lamothe
Complex Manager
Maine-New Hampshire
Fish and Wildlife Service Complex

cc: FERC, Secretary (e-filed)
BBHP, Kelly Maloney (via email)
NMFS, Matt Buhyoff, Dan Tierney (via email)
DMR, Gail Wippelhauser, Casey Clark (via email)
DEP, Chris Sferra (via email)
USFWS, Bryan Sojkowski (via email)
ES: JRosset:7-16-21:(603)309-4842

References

Brown, L., A. Haro and T. Castro-Santos. 2009. Three-dimensional movement of silver-phase American eels in the forebay of a small hydroelectric facility. Pages 277–291 in J. M. Casselman and D. K. Cairns, editors. Eels at the edge: science, status, and conservation concerns. American Fisheries Society, Symposium. 58, Bethesda, Maryland.

Document Content(s)

September 20, 2021

UNITED STATES OF AMERICA

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Brookfield White Pine Hydro, LLC Project No. 2322-071

KENNEBEC COALITION'S AND CONSERVATION LAW FOUNDATION'S JOINT MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS IN OPPOSITION TO THE AMENDMENT APPLICATION TO INCORPORATE INTERIM SPECIES PROTECTION PLAN INTO THE PROJECT LICENSE

These Motion to Intervene, Protests, Comments, including demand for Commission compliance with the National Environmental Policy Act, 42 U.S.C. § 4321 et seq., are filed by the Kennebec Coalition and Conservation Law Foundation pursuant to the Notice of Amendment Application to Incorporate an Interim Species Protection Plan ("ISPP") into the Project License and Soliciting Comments, Motions to Intervene, and Protests, issued by the Federal Energy Regulatory Commission ("Commission" or "FERC"), on August 19, 2021. The amendment application was filed by Brookfield White Pine Hydro, LLC ("Brookfield") as licensee of the Shawmut Hydroelectric Project (P-2322).

In accordance with the Notice and the Commission's Rules of Practice and Procedure, 18 C.F.R. §385.210, .211 and .214, the Atlantic Salmon Federation U.S. ("ASF"), the Kennebec Valley Chapter of Trout Unlimited ("KVTU"), the Natural Resources Council of Maine ("NRCM"), Maine Rivers (hereinafter collectively referred to as the "Kennebec Coalition"), and the Conservation Law Foundation ("CLF"), hereby move to intervene in the above-captioned proceeding and to protest and comment on the amendment application that has been filed with the Commission for these Projects.

1. MOTION TO INTERVENE

The Kennebec Coalition is a longstanding coalition of non-profit organizations consisting of the Atlantic Salmon Federation U.S.; the Kennebec Valley Chapter of Trout Unlimited; the Natural Resources Council of Maine; and Maine Rivers. Each member, except Maine Rivers, is a signatory to the *Agreement Between Members of the Hydro Developers Group, the Kennebec Coalition, the National Marine Fisheries Service, the State of Maine, and the U.S. Fish and Wildlife Service ("Agreement")* dated May 27, 1998 ("The KHDG Agreement").[1] Kennebec Coalition members have long been involved with all aspects of the protection and restoration of the Kennebec River, including filings with the Commission on matters involving the implementation of the KHDG Agreement.[2]

Members of ASF, KVTU, Maine Rivers and NRCM use the Kennebec River for recreational, educational, and aesthetic pursuits. Their members fish, boat and otherwise enjoy the watershed in the vicinity of the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects along the Kennebec. Further, Kennebec Coalition members have broad and deep organizational interests in the Commission's equal consideration of power and non-power

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[1] A Commission order issued on September 16, 1998, approved the KHDG Agreement and incorporated its fish restoration goals and fish passage provisions into the licenses of the four projects – Lockwood, Hydro-Kennebec, Shawmut, and Weston. *Edwards Manufacturing Co., Inc., and City of Augusta, Maine*, 84 FERC ¶ 61,227 (1998) (incorporating May 27, 1998 Lower Kennebec River Comprehensive Settlement Record (KHDG Agreement)).

[2] The KHDG Agreement, Part I(B), coins the term "Kennebec Coalition" to name the respective associations herein, to wit: "the Atlantic Salmon Federation; Kennebec Valley Chapter of Trout Unlimited; the Natural Resources Council of Maine; and Trout Unlimited." 84 FERC ¶ 61,227 & n.1. Maine Rivers has since joined the Kennebec Coalition in filings before this Commission, as Maine Rivers was formed in 2002 after the KHDG Agreement was signed and approved by the Commission. *See, e.g.,* FERC Order, FERC Accession No. 20200713-3034 (July 13, 2020) at ¶ 14.

values in hydropower licensing pursuant to Sections 4(e) and 10(a) of the Federal Power Act ("FPA"). Finally, as signatories to the KHDG Agreement, ASF, NRCM, and KVTU and their members have an interest in upholding and enforcing the terms of the KHDG Agreement and the fish restoration goals incorporated into the Project licenses and present in this proceeding.

Further, the Kennebec Coalition has 1) moved to intervene on August 29, 2020 with protests and comments opposing the issuance of a new license for the Shawmut Project;[3] 2) moved to intervene on September 4, 2020 with protests and comments opposing retroactive extension of the expired the interim species protection plan which had governed – until its expiration on December 31, 2019 – the four hydropower projects on the lower Kennebec of the affiliated Brookfield licensees (Lockwood [P-2574], Hydro-Kennebec [P-2611], Shawmut [P-2322], and Weston [P-2325]);[4] and 3) moved to intervene on August 16, 2021 with protests and comments opposing the Draft Environmental Assessment for the Shawmut Project relicensing proceeding.[5]

Specific descriptions of the moving-party Intervenors joining herein, is as follows:

(a) The Atlantic Salmon Federation U.S. ("ASF"), is a 73-year-old international non-profit organization dedicated to conserving and restoring wild Atlantic salmon and the ecosystems on which their well-being and survival depends. ASF and its Maine Council represent a dozen angling, conservation, and watershed education organizations in the State of Maine and more than 5,000 members and volunteers in the United States. ASF has been engaged on Kennebec River fisheries and dam issues for more than a quarter of a century and

[3] FERC Accession No. 20200831-5332.

[4] FERC Accession No. 20200904-5099.

[5] FERC Accession No. 20210816-5050.

has devoted substantial time and money in efforts to restore Atlantic salmon and other native sea-run fish in the Kennebec River Watershed. This includes supporting the removal of the Edwards, Fort Halifax and Madison Electric Works Dams and contributing to the efforts of the State of Maine in the Sandy River (a major tributary of the Kennebec River that enters the main stem of the river near Madison) to restore the endangered Atlantic salmon population utilizing innovative in-stream egg rearing techniques. ASF is currently implementing a $2.5 million restoration initiative on Temple Stream, a major tributary of the Sandy River, involving the removal of the only dam on the stream and the replacement of two road-stream crossings. Once completed in 2022, ASF's work will fully restore access to more than 50 miles of high-quality, designated critical habitat for endangered Atlantic salmon. In addition, ASF has substantial scientific expertise in Atlantic salmon biology and management and the ecological interactions between salmon and other sea-run fish species. Finally, as a signatory to the KHDG Agreement, ASF has a fundamental interest in ensuring that the outcome of the current proceeding is consistent with the terms of the Agreement.

(b) Kennebec Valley Chapter of Trout Unlimited ("KVTU") is one of six Maine chapters of Trout Unlimited, a national conservation organization whose mission is to conserve, protect and restore North America's cold water fisheries and their habitat. KVTU members fish and recreate on the Kennebec River and its tributaries, have deep knowledge of the river and its fisheries, and have long been involved in fisheries conservation and restoration in the Kennebec watershed. KVTU worked with the Maine Department of Marine Resources ("MDMR") to initiate the current egg-planting project in the Sandy River that is the basis for salmon restoration in the Kennebec watershed; played a leading role in the removal of the Madison Electric dam, which opened the entire mainstem Sandy River to passage for endangered Atlantic salmon and other sea-run fish species; and advocated for the removal of the Fort Halifax dam to open the Sebasticook River to fish passage. KVTU demonstrated its interest in the Kennebec River watershed and its restoration, as a separate signatory to the KHDG Agreement with Trout Unlimited, and by KVTU's participation in Commission proceedings relating to the KHDG Agreement.

(c) Maine Rivers is a nonprofit corporation with a mission to protect, restore and enhance the ecological health of Maine's river systems. For close to two decades, Maine Rivers has worked to achieve its mission and has shown a strong interest in the recovery of the Kennebec River, including through the successful organization of the Maine Rivers conference on the Kennebec in 2014, entitled Restoring Fish for People and Wildlife, an event bringing together more than 100 people to focus on the restoration of sea-run species.

(d) NRCM is a 62-year-old environmental advocacy organization with over 25,000 members and supporters. NRCM's mission is "to protect, conserve and restore Maine's environment, now and for future generations." NRCM members, staff, and the board of directors all have significant interests in the Kennebec River watershed through their use, enjoyment, and research of this area. NRCM was previously an intervenor and participant in the settlement of the Edwards Project proceedings, which had resulted in the Commission's order denying a new license of the Edwards Project (81 FERC ¶ 61,255), removal of the Edwards dam, and incorporation of the KHDG Agreement fish passage terms into the subject licenses of the next four hydroelectric projects in the lower Kennebec watershed, in *Edwards Manufacturing Co., Inc., and City of Augusta, Maine*, 84 FERC ¶ 61,227. NRCM has demonstrated long-standing interest in the recovery of Kennebec fisheries in general, including through its comments and efforts to fully implement the KHDG Agreement and to otherwise ensure the restoration of the Kennebec River and its fisheries. NRCM has both individually and as a member of the Kennebec Coalition, demonstrated an active interest in the fisheries restoration activities on the Kennebec River and watershed. NRCM has demonstrated this interest through activities including but not limited to participation in the development and review of the Kennebec Hydro Developers Group Annual Reports, continuing outreach and policy efforts regarding restoration of the Kennebec River and its fisheries, advocacy to improve water quality in the Kennebec, and activities related to the licenses for hydropower projects that are governed by the KHDG Agreement.

(e) Founded in 1966, CLF is a non-profit advocacy organization with 5000 members across New England, including approximately 500 in Maine. CLF works to solve the environmental problems threatening the people, natural resources, and communities of New England. CLF's advocates use law, economics and science to design and implement strategies that conserve natural resources, protect public health, and promote vital communities in our region. CLF has members in many of the communities that border the Kennebec River, including Waterville, Augusta, Skowhegan and Fairfield, the sites of these Projects. For more than three decades, CLF has worked to restore habitat in New England's coastal rivers for important species such as herring, alewives, shad and salmon. CLF's work to restore key forage fish has stretched from the Connecticut River to the St. Croix River and is an integral part of our work to restore New England's coastal and ocean fisheries. Members of CLF use the Kennebec River for recreational, educational, and aesthetic pursuits. CLF members fish, boat and otherwise enjoy the watershed in the vicinity of the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects along the Kennebec. Further, CLF members have broad and deep organizational interests in the Commission's equal consideration of power and non-power values in hydropower licensing pursuant to Sections 4(e) and 10(k) of the Federal Power Act ("FPA"). CLF is engaged on Kennebec River fisheries and dam issues in collaboration with the Kennebec Coalition, a group of organizations who themselves have been working for more than a quarter of a century to restore Atlantic salmon and other native sea-run fish in the Kennebec River Watershed. This collaboration resulted in the joint filing by the Kennebec Coalition and the CLF of Protests and Comments in opposition to the Draft Environmental Assessment for the Shawmut Project Hydropower License.[6] This collaboration also results in the present joint filing.

2. KENNEBEC COALITION and CLF PROTESTS, COMMENTS, AND DEMAND FOR COMPLIANCE WITH NATIONAL ENVIRONMENTAL POLICY ACT ("NEPA").

The relevant procedural history of the Shawmut Project requires careful consideration. The present application requests Commission approval to amend the license to incorporate an ISPP, which expired on December 31, 2019. The "ISPP" was an interim plan approved by a Biological Opinion issued by the National Marine Fisheries Service ("NMFS") on July 19, 2013, following formal consultation with the Commission under section 7 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536.[7] The 2013 Biological Opinion contained an Incidental Take Statement, setting forth the terms of any take authorization at the Shawmut Project, for "take" of listed species, the Gulf of Maine ("GOM DPS") of Atlantic salmon. The Incidental Take Statement and take permits were valid through December 31, 2019. The Biological Opinion

[6] FERC Accession No. 20210816-5050.

[7] National Marine Fisheries Service, Biological Opinion, July 19, 2013; FERC Accession No. 20130723-0012.

made it abundantly clear, that both the ISPP and any incidental take authorization at the Shawmut Project would expire on December 31, 2019.[8]

The fact of expiration of the take authorization was reiterated on the Commission's record, in relation to Brookfield's failure to submit a sufficient and compliant Final Plan *before* the December 31, 2019 expiration, and even in year 2020 thereafter.[9] Brookfield still has not submitted a compliant and sufficient Final Plan for the Shawmut Project. This is exemplified by the NMFS correspondence to this Commission of August 25, 2021, noting the deficiencies in even the current request to extend the expired ISPP terms to the remaining life of the Shawmut license.[10]

The Shamwut Project license expires January 31, 2022. This Commission approved the ISPP, in reliance upon the 2013 Biological Opinion and its interim terms, on May 19, 2016.[11] This Commission granted the licensee an additional year on its license term, on December 11, 2018, thus setting the January 31, 2022 project license expiration date.[12] That extension was granted to the licensee based upon Brookfield's promise to submit a Final Plan (together with the draft Biological Assessment for reinitiation of section 7 consultation under the ESA) before the December 31, 2019 expiration of the ISPP and the ESA take authorization.[13] Brookfield failed

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[8] National Marine Fisheries Service, Biological Opinion, July 19, 2013 at 149 ("The incidental take provided by this Opinion is valid until 2019. In 2020 this Opinion will no longer be valid for Atlantic salmon."); FERC Accession No. 20130723-0012.

[9] FERC Accession No. 20200904-5099 at PP. 6-7.

[10] FERC Accession No. 20210826-5106.

[11] *Merimil Limited Partnership*, 155 FERC ¶ 61,185 (2016).

[12] *Brookfield White Pine Hydro, LLC*, 165 FERC ¶ 62,152 (2018).

[13] 165 FERC ¶ 62,152 at ¶¶ 4-5 ("Brookfield is currently in the process of developing a final BA and Species Protection Plan (SPP) for Atlantic salmon for the four lower Kennebec River projects, ahead of the expiration date of the ISPP in December 2019. . . . Brookfield states that the extension [of the Shawmut license term to January 31, 2022] would allow it to incorporate the findings of the fish passage feasibility assessment, BA, and SPP into the

to meet this promise. Instead, a deficient plan was submitted on December 31, 2019, which has since been replaced by another plan submitted on June 1, 2021, which NMFS has recently indicated requires additional information in order to be ready for section 7 formal consultation.[14]

Thus, the present application requests the Commission approve *an expired* ISPP, which had been entered by this Commission in reliance on a now-expired *2013* Biological Opinion, following a requested one-year extension by the licensee to the overall license term. Throwing salt into the wounds that Brookfield has inflicted on this process, the Shawmut Project relicensing (P-2322-069), now suffers yet another potential year's delay resulting from Brookfield's unilateral withdrawal of its section 401 water quality certification application upon the Maine Department of Environmental Protection's ("MDEP") issuance of a draft order denying water quality certification under the Clean Water Act, 33 U.S.C. § 1341.

Given these considerations, this Commission must hold any decision on the present application in abeyance, pending formal section 7 review and approval by NMFS under the ESA, because – to be candid – there are serious issues posed on whether the ongoing operations of the Shawmut Project for the remaining term of its license to January 31, 2022, jeopardize the survival and recovery of Atlantic salmon. And this is true even if terms of the ISPP were incorporated into the license, because those terms are now over 8 years old, expired, and have been placed in issue by NMFS in the context of an upcoming formal consultation under section 7.[15]

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final license application."); and ¶ 8 ("Extending the license term for the Shawmut Project would allow Brookfield to complete the BA and SPP for the protection of Atlantic salmon *before filing its final license application*.") (italics emphasis added).

[14] FERC Accession No. 20210826-5106.

[15] National Marine Fisheries Service, Notice of Intervention and Comments at PP. 2-3; FERC Accession No. 20200904-5050 ("As seven years have elapsed since we issued our Opinion in July 2013, any new consultation would need to consider changes to the status of the species and the environmental baseline, ..."); *see also* National

As evidence for the assertion that the Shawmut Project operations raise serious questions about jeopardy of Atlantic salmon, and hence this Commission's responsibility to conserve the species under the ESA,[16] we rely on and incorporate herein all of the points made in our protests and objections to the Draft Environmental Assessment issued by FERC staff in the Shawmut Project relicensing proceeding, P-2322-069. That protest and those comments are attached to this filing, and should be considered herein in full.[17]

Included in the attached protest and objections is the Kennebec Coalition and CLF demand that this Commission order the preparation of an environmental impact statement in accordance with the Commission's responsibilities and the procedural mandates of the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 et seq. The present request also triggers the requirement of NEPA scrutiny. The Shawmut Project is part of a four-project system on the lower mainstem of the Kennebec River, blocking the migration corridor for the listed species. Events in June 2021 at the Lockwood Project, involving flashboard replacement and repair, resulted in the unauthorized "take" of the listed species, in a well-documented report on this "take" submitted to this Commission.[18] The Shawmut Project is positioned to block the outmigration of Atlantic salmon kelts during the upcoming fall season downstream migration. The Shawmut Project currently has no valid incidental take statement or incidental take

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Marine Fisheries Service, letter to FERC Secretary Kimberly D. Bose (August 26, 2021) (Attachment A) (noting "the need to safely pass the entire smolt run, as well as outmigrating alosines" and noting "that in 2021, nearly 2 dozen salmon smolts were stranded on the ledges at the Lockwood Project on June 15 during flashboard repair, ...").

[16] 16 U.S.C. § 1531(c) ("It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this chapter.").

[17] FERC Accession No. 20210816-5050.

[18] FERC Accession No. 20210701-5242 (Attachment 1, Maine Department of Marine Resources (Jennifer Noll). June 17, 2021. Field Summary of Atlantic Salmon Stranding Rescue at Lockwood Dam.).

authorization under the ESA. Far greater measures than those set forth in an expired interim plan that is now more than eight years old are required to avoid any "take" of salmon at the Shawmut Project during downstream migrations. Indeed, at the present time, without any "take" authorization under the ESA, after years of delay following take permit expiration, any and all operations at the Shawmut Project that are reasonably likely to result in "take" during the fall outmigration season (October 15 through December 31) must cease.

To the extent necessary, we also include the Kennebec Coalition and CLF motion to intervene, protests, and comments in opposition to the applications to incorporate the final species protection plan in the other three Brookfield projects in the action area in issue, Lockwood (P-2574-092), Hydro-Kennebec (P-2611-091), and Weston (P-2325-100).[19] It is necessary for the Commission to consider these other projects, because any NEPA analysis requires this cumulative consideration in relation to Shawmut operations adversely affecting the environment. In addition, the ESA analysis includes the issues of how delayed mortality resulting from the Shawmut Project factors into overall delayed mortality during migrations, and thus factors into the jeopardy analysis under the ESA. Furthermore, Brookfield promised this Commission that the Shawmut Project would be considered as part of a comprehensive four-project analysis, and its continuing operations for the remaining life of its license should not be arbitrarily segregated from the comprehensive problem posed by the barrier and impediments of all four hydropower projects on the lower mainstem of the Kennebec River. We therefore incorporate by reference and attach to the present filing, these relevant objections to the final plans proposed for the Lockwood, Hydro-Kennebec, and Weston projects, because those comments are equally applicable to the deficiencies in plans for the Shawmut Project for the remaining life of its license to January 31, 2022.

[19] FERC Accession No. 20210825-5088.

Lastly, this Commission should order that Brookfield's unilateral withdrawal of its water quality certification application at the Shawmut Project, under section 401 of the Clean Water Act – when that unilateral withdrawal occurred in the face of the MDEP draft order to deny water quality certification – should independently require section 7 formal consultation by the Commission in order to be allowed. The withdrawal potentially not only adds an additional year to the relicensing process, it has ramifications suggesting that the current water quality certification under the current not-yet-expired license of the Shawmut Project, requires re-examination. This may therefore call for the exercise of the Commission's reservation authority to reopen the Shawmut Project license.[20] All of the long, delay-engendering present proceedings on SPP and BA preparation and analysis, combined with the required NEPA "hard and honest look" at environmental consequences (a NEPA analysis that cannot be lightly skipped by the Commission) certainly will satisfy the Commission's standards for a premise of investigation to reopen a license.[21]

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[20] Since 1991, the Commission's reservation of authority to reopen a license is incorporated in all hydropower licenses. See Article 15 of standard form L-3 of the licenses. The Commission's reservation of authority in this respect is also inherent in the license and in Commission practice and protocol. *See Phelps-Dodge Morenci, Inc.*, 94 FERC ¶ 61,202 (Feb. 23, 2001):

> Rather, when the Commission becomes aware of information to suggest that ongoing operation of a project may affect a threatened or endangered species, it is our practice to direct our staff to investigate the situation, in consultation with the licensee, the FWS (or NMFS, as appropriate), and any other interested participants, to determine what effects, if any, may be occurring, and what changes, if any, should be considered to avoid or mitigate those effects.

Id. at 6 and n.40. If, as in this case, no changes are available to "avoid or mitigate" those effects, this Commission must then seriously revisit for each Project the Federal Power Act's vision of giving "equal consideration" to the "protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), . . . and the preservation of other aspects of environmental quality." 16 U.S.C. § 797(e).

[21] *See Hoopa Valley Tribe v. FERC*, 629 F.3d 209 (D.C. Cir. 2010) (while the Commission does not undertake reopener proceedings lightly, it may do so after first investigating what effects, if any, may be occurring and whether there is a need to require changes to address those effects).

Respectfully submitted, this 20th day of September 2021,

The Kennebec Coalition by:

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CERTIFICATE OF SERVICE

I, Russell B. Pierce, Jr., Esq., hereby certify that on September 20, 2021 a copy of these comments was transmitted by electronic means to each of the persons on the Service list maintained by the Secretary of the Commission.

/s/ Russell B. Pierce, Jr.
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August 14, 2021

UNITED STATES OF AMERICA

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Brookfield White Pine Hydro LLC   Project No. 2322-069

KENNEBEC COALITION'S AND THE CONSERVATION LAW FOUNDATION'S JOINT PROTESTS AND COMMENTS IN OPPOSITION TO THE "DRAFT ENVIRONMENTAL ASSESSMENT FOR HYDRPOWER LICENSE" FOR THE SHAWMUT PROJECT NUMBER 2322-069, MAINE

Pursuant to the Notice of Availability of Draft Environmental Assessment and Revised Procedural Schedule (July 1, 2021), the Kennebec Coalition and the Conservation Law Foundation jointly submit these Protests and Comments in opposition to the Draft Environmental Assessment for Hydropower License.[1]

In accordance with the Commission's Rules of Practice and Procedure, 18 C.F.R. §385..214, the Atlantic Salmon Federation U.S. ("ASF"), the Kennebec Valley Chapter of Trout Unlimited ("KVTU"), the Natural Resources Council of Maine ("NRCM"), and Maine Rivers (hereinafter collectively referred to as the "Kennebec Coalition") timely moved to intervene in the above-captioned proceeding on August 31, 2020[2] with the

[1] Commission staff also indicated that the Draft EA would serve simultaneously as the Commission's Biological Assessment for purposes of initiation of formal section 7 consultation with NMFS under the Endangered Species Act (the "ESA"), 16 U.S.C. § 1536, for the relicensing of the Shawmut Project. FERC Accession No. 20210709-3034 (Turner to Petony correspondence requesting formal consultation on the relicensing of the Shawmut Project, July 9, 2021) ("The DEA [Draft EA] serves as our biological assessment and EFH [essential fish habitat] assessment."). Hence these Comments will also serve as the Kennebec Coalition's and Conservation Law Foundation's protests and comments on the Biological Assessment under the ESA, and on the EFH assessment.

[2] FERC Accession No. 20200831-5332; Draft Environmental Assessment (hereafter "Draft EA") section 1.4.2.

Kennebec Coalition's protest and comment on the hydroelectric application for issuance of a new license for the Shawmut Project FERC No. 2322-069. The Kennebec Coalition has therefore been granted party status by operation of 18 C.F.R. 385.214(c)(1).

The Conservation Law Foundation ("CLF") joins the Kennebec Coalition in these Protests and Comments in opposition to the Draft Environmental Assessment for Hydropower License, and has filed a motion to intervene pursuant to 18 C.F.R. 385.214(b)(1).[3]

THE NEPA FINDINGS AND ANALYSIS ARE ARBITRARY AND CAPRICIOUS

The Commission staff determination in the Draft Environmental Assessment ("Draft EA") that issuance of a new license for the Shawmut Project, with the additional staff-recommended measures, would not constitute a major federal action affecting the quality of the human environment, is clearly arbitrary and capricious. As we demonstrate in these comments, the Draft EA does not take a "hard and honest look" at the environmental consequences of relicensing the Shawmut Project. As a result, the measures proposed by Commission staff are not sufficient to reduce those consequences to a minimum. For this reason, the proposed finding of no significant impact means this Draft EA must be rejected, and an environmental impact statement ("EIS") must be prepared before the Shawmut relicensing application is considered by the Commission.[4]

[3] FERC Accession No. 20210813-5093.

[4] The Kennebec Coalition and resource agencies object to the Commission's failure to exercise its discretion and order an EIS at the outset of this proceeding as authorized by 18 C.F.R. § 380.5(a). Exercise of this discretionary authority may still occur by this Commission now ordering resubmission to staff for reconsideration of the inadequacies in the EA. *Id.* ("Depending on the outcome of the environmental assessment, the Commission may . . . prepare an environmental impact statement."). We repeat that at the

I. Introduction

The primary function of the National Environmental Policy Act ("NEPA")[5] is to compel federal agencies "to take a hard and honest look at the environmental consequences of their decisions."[6] In *American Rivers and Alabama Rivers Alliance v. Federal Energy Regulatory Commission*, 895 F.3d 32, 49 (D.C. Cir. 2018), the Court articulated the following analytic steps required by NEPA:

- Identify accurately the relevant environmental concerns;
- Take a hard look at the problem in preparing the environmental assessment;
- Make a convincing case for any finding of no significant impact;
- Show why, if there is an impact of true significance there are sufficient safeguards to reduce the impact to a minimum; and
- If such safeguards are not in place or insufficient, then an EIS must be prepared before the action is taken.[7]

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outset of these proceedings on the final license application, USFWS, NMFS and MDMR all called for preparing an EIS rather than an EA: Letter to Vince Yearick, Director , Division of Hydropower Licensing, FERC, from Anna Harris, Project Leader, Maine Field Office, Fish and Wildlife Service, United Sates Department of the Interior, August 9, 2017 [**FERC Accession No. 20170809-5067**]; Letter to Secretary Bose, Federal Energy Regulatory Commission from Julie Crocker, ESA Fish Recovery Coordinator, (NMFS Greater Atlantic Regional Fisheries Office), August 16, 2017 [**FERC Accession No. 20170816-5134**] ("given the existing information on project effects, we recommended that FERC analyze the impacts of the project by preparing an EIS, rather than an EA."); Letter to Secretary Bose, Federal Energy Regulatory Commission from Patrick C. Keliher, Commissioner, MDMR, August 9, 2017 **[FERC Accession No. 20170817-5120**] ("However, given the existing information on project impacts, summarized below, we recommend that the Commission analyze the impacts of the project by preparing an EIS, rather than an EA.").

[5] 42 U.S.C. 4321 et seq.

[6] *American Rivers and Alabama Rivers Alliance v. Federal Energy Regulatory Commission*, 895 F.3d 32, 49 (D.C. Cir. 2018).

[7] *American Rivers*, 895 F.3d at 49.

Under this test, "the Commission's Assessment will pass muster only if it undertook a 'well-considered' and 'fully informed' analysis of the relevant issues and opposing viewpoints."[8]

The context in which the proposed action is to be taken is the "baseline" and must include the existing conditions and the enduring effect of past actions.[9] The analysis must then turn to a searching evaluation of the likely impact of the proposed action, including "cumulative effects" which are impacts on the environment that result from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[10]

While "significance typically depends on the action's effects in the immediate locale, rather than in the broader ecosystem or world as a whole," "intensity" refers to the " 'severity' or acuteness of the impact on the contextualized environment."[11] Obviously, this is a fact driven analysis, but there is little doubt about the scope and impact of the federal action involved here: relicensing of a hydropower project that is one of four adjacent hydropower projects owned and operated by the same entity that have a cumulative and combined impact. This relicensing review is taking place at the same time that 1) the State of Maine is undertaking a significant revision of its proposed river

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[8] *Id*. (citing and quoting in part *Myersville Citizens for a Rural Cmty., Inc. v. FERC*, 783 F.3d 1301, 1324-25 (D.C. Cir. 2015)).

[9] *Id*. ("Evaluating an action's environmental 'significance' requires analyzing both the context in which the action would take place and the intensity of its impact.") (citing 40 C.F.R. § 1508.27).

[10] 40 C.F.R. § 1508.27 (quoted in *American Rivers*, 895 F.3d at 54); Draft EA at § 3.2, p.24 n.21 (referencing CEQ's 1978 regulations).

[11] *American Rivers*, 895 F.3d at 49-50.

management plan encompassing the same four projects;[12] 2) state and federal natural resource agencies are recommending the removal of the Shawmut Project; and 3) the Shawmut Project relicensing is undergoing an almost simultaneously initiated ESA section 7 consultation process with the other three hydropower projects.[13] The environmental impacts of relicensing of the Shawmut Project in this context are clearly significant and intense.

The baseline in this proceeding is unique because the Shawmut Project is the third dam on the Kennebec River and currently has no fish passage. The first dam on the Kennebec (Lockwood, FERC Project No. P-2574) has a fish lift that is a dead-end for endangered Atlantic salmon,[14] which are trapped in the lift and then trucked past the Hydro-Kennebec Project (FERC No. 2611), Shawmut (FERC No. 2322), and the Weston Project (FERC No. 2325) up to the Sandy River – the locale of critical, ideal spawning habitat; other species captured at Lockwood, including alewives, blueback herring, and shad, are trucked to various upstream impoundments.[15] All four of these dams are located within the designated critical habitat of the Gulf of Maine Distinct Population Segment ("GOM DPS") of endangered Atlantic salmon.[16] The Draft EA cites a dismal 79% for salmon passage effectiveness at Lockwood, but even this number is too high, by

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[12] Draft EA at p. 188 (referencing and acknowledging MDMR process of plan revision).

[13] FERC Accession No. 20210709-3034 (Turner to Petony correspondence requesting formal consultation on the relicensing of the Shawmut Project, July 9, 2021); FERC Accession No. 20210726-3031 (Nguyen to Crocker correspondence requesting formal consultation on Final Plan proposing actions for the remaining license terms of the Lockwood, Hydro-Kennebec and Weston Projects).

[14] Draft EA at p. 40.

[15] Draft EA at p. 77.

[16] 74 Fed. Reg. 29,300 (Designation of Critical Habitat for Atlantic Salmon (*Salmo salar*) Gulf of Maine Distinct Population Segment) (June 19, 2009).

significantly ignoring other impacts. The fish-lift causes severe delays as well. The National Marine Fisheries Service ("NMFS") stated in a 2018 letter to Brookfield that:

> We note that consistent with the first season, the results of the second season demonstrated unequivocally that: 1) The Lockwood facility demonstrates poor upstream passage efficiency for Atlantic salmon; 2) Atlantic salmon are highly attracted to the "bypass" reach of the Lockwood facility; and 3) the Lockwood facility imposes a significant delay upon the upstream migration of Atlantic salmon. Although the study did not address the facility's upstream passage effect on other species, it is reasonable to assume that other diadromous species experience similar effects.[17]

Thus, at the present time, no fish pass upstream by the Shawmut project (except in tank trucks after being trapped at Lockwood). Under the required "cumulative analysis" of NEPA, the "reasonably likely" future actions proposed by the project licensees, including those not yet approved by the Commission,[18] must be included in the baseline and cumulative effects analysis. For example, the untested efficiency of the Hydro-Kennebec fish passage facilities (which are just above Lockwood), and the planned fish passage at the Weston Dam which has not yet been approved by any of the resource agencies, must be included in the baseline context, despite their uncertain future results. The following Comments of the Kennebec Coalition and CLF set forth the best available information establishing, beyond cavil, that the four-dam fish passage regime is reasonably certain to *fail*.[19] The Draft EA conclusion that "the development of fishways [at all four projects in the system] are reasonably certain to facilitate fish passage on an annual basis for the numbers of each species specified by NMFS and recommended by

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[17] Letter from Dan Kircheis (Acting ESA Fish Recovery Coordinator, NMFS Greater Atlantic Regional Fisheries Office) to Kelly Maloney, Brookfield re NOAA Fisheries comments on draft 2017 KHDG report (March 27, 2018) at 1 [FERC Accession No. 20180329-5166].

[18] Brookfield has just filed a Final Species Protection Plan and Biological Assessment for the four-dam watershed, FERC Accession No. 20210601-5152.

[19] The List of References to literature cited in these Comments is attached hereto.

Maine DMR" is arbitrary and capricious, especially in light of the record dispute with this conclusion by NMFS and the Maine Department of Marine Resources ("MDMR").[20] Part of taking an "honest" look at environmental consequences under NEPA is to undertake a "fully informed" and "well-considered" analysis of "opposing viewpoints."[21] As demonstrated below in these Comments, the Draft EA fails to do such an analysis.

Another glaring deficiency with the Draft EA is the complete lack of performance standards for alosine or other anadromous species in the Brookfield fishway proposals.[22] The absence of performance standards for these fish is a clear failure in the staff-recommendations and environmental impact analysis of the proposal, since the presence of such fish plays a significant role not only in the recovery of Atlantic salmon, but also in the health and quality of the riverine environment extending far beyond the project boundaries. To put it bluntly, those other species have a profound effect on the environmental analysis, yet they are not even included in the staff-recommended additional measures. That omission completely undermines a finding of no significant impact.

Indeed, the only support for the Commission staff's finding of no significant impact is anchored in staff's acceptance of the performance criteria for upstream and

[20] **FERC Accession No. 20200828-5176** (NMFS Comments, Recommendations, etc. for the Shawmut Project) at pp. 43-44 ("Accordingly, a decision to decommission and remove the Shawmut Project and thereby remove a significant barrier to recovering an endangered species, and support the restoration of several anadromous fish, would fulfill the Commission's mandate under the FPA to ensure the best comprehensive use of a waterway."); **FERC Accession No. 20200828-5199** (Maine Department of Marine Resources ("MDMR") Comments on the Final License Application for Shawmut) at Executive Summary on Shawmut FLA) at Executive Summary p. 2 (noting MDMR's development of an amendment to the 1993 Kennebec Management Plan "as a comprehensive plan that will include dam decommissioning and removal' and supporting request to FERC to "analyze decommissioning and removal as a preferred option").

[21] *American Rivers*, 895 F.3d at 49.

[22] Draft EA at p. 38.

downstream salmonid passage at Shawmut and the other three dams in the watershed proposed by Brookfield, supplemented by a staff recommendation for effectiveness studies for salmon passage only.[23] Brookfield might as well have just written the environmental assessment itself. At a minimum, staff's conclusion that "[b]ased on our independent analysis, we find that the issuance of a new license for the Shawmut Project, with the additional staff-recommended environmental measures would not constitute a major federal action affecting the quality of the human environment" cannot survive the required level of review and must be rejected by the Commission. Specifically, the Commission must reject that conclusion because:

1. The "independent analysis" failed to take a hard look at the environmental consequences of the performance standards for upstream passage of endangered Atlantic salmon at Shawmut (95%) and for the four dams collectively (81.4 %) proposed by Commission staff, including whether those performance standards were reasonably likely to even be achieved under best available information. Draft EA at 15;

2. The "independent analysis" failed to take a hard look at the environmental consequences of proposed downstream passage performance standards of endangered Atlantic salmon at Shawmut (96%) and for the four dams collectively (84.9%), including whether those performance standards were reasonably likely to even be achieved under best available information. Draft EA at 16;

3. The failure to include performance standards for passage of alosines in the staff recommendation based on monetary costs is erroneous and fails the hard look test, and;

4. The failure to take a "hard and honest" look at dam removal and decommissioning of Shawmut, characterizing it as "speculative and premature" (Draft EA at 188), and the implication that the relicensing with the staff recommendations is a "better than nothing approach," falls far short of the NEPA and *American Rivers* analytic standards.

[23] Draft EA at Section 5.1.2, pages 106-117, and Section 5.1.3 at 117-121 ("We conclude that any passage benefits of performance standards for alosines (including shad) are not justified by the additional cost of up to $894,470 . . . ." Draft EA at p.120.

Each of these deficiencies of the Draft EA are addressed in the following four sections of these Comments.

A. Failure to take a "Hard Look" at Upstream Fish Passage Performance Standards

While the Shawmut fish lift was not designed to meet a passage effectiveness standard for Atlantic salmon of 95%, despite Commission staff's claims that it was, this standard was used in the Draft EA analysis and findings.[24] In the Interim SPP filed by Brookfield for the Shawmut Project on May 31, 2021, Brookfield proposes a passage effectiveness of 96%, which is the same standard that was included in an NMFS prescription. In the Draft EA, Commission staff does not question the discrepancy between the standards, while observing that there is no guarantee the 96% passage effectiveness standard could be met with the proposed Shawmut fish lift, and that if Brookfield is "to achieve the higher [96%] standards, then Brookfield would likely need to construct additional fishways such as a second fish lift to attempt to meet them." But then the staff concludes that the estimated gains in passage effectiveness for a critically endangered species were insufficient to justify the annual costs of an additional fishway.[25]

From these mixed signals, it is clear that the Draft EA dodges taking a hard look at the record and in formulating an assessment of available and appropriate mitigation, protection and enhancement measures. While the difference between a 95% and a 96% passage effectiveness rate may not appear numerically significant, when it is considered

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[24] Draft EA at p. 118.

[25] Draft EA at p. 118.

that under best current information the 95% passage standard is itself as unlikely to be achieved as the 96% standard, and that the standards all address passage of an endangered species which, without game-changing recovery actions, is on the brink of extinction, the Draft EA clearly fails to take a hard look at issues underlying the reliability of actual performance of fishways at Shawmut, and the role that unreliability of effective passage plays in the system as a whole.

i. The proposed 95% upstream passage standard is unrealistic, and we are unaware of other dams that meet this standard.

Commission staff is proposing an unrealistic 95% upstream passage standard for Atlantic salmon at the Shawmut Dam. There is no justification for that proposed standard in peer-reviewed literature; in fact, extensive research shows that such standards have never been consistently reported within 48 hours of approach at any dam, on any river in the world.

While high passage success has been achieved at some hydropower dams, such as the Milford Dam on the Penobscot River in Maine, the Finsjö Dam on the Emån River in Sweden, and the Herting Dam on the Ätran River in Sweden, delays are quite common and passage is highly variable between years (Dauble and Mueller, 1993; Calles and Greenberg, 2006; Caudill et al., 2007; Holbrook, 2009; Noonan et al., 2012; Sigourney et al., 2015).[26] The reality of passage effectiveness standards is much less rosy. An extensive review of upstream salmonid passage studies revealed a mean passage efficiency of 61.7% (Noonan et al., 2012). Analyses of cumulative success passing multiple dams, as is required to reach spawning grounds above the Kennebec/Sandy

[26] As stated previously, the Appendix to these Comments contains the list of References to literature cited in these Comments.

River confluence in this case, are even greater cause for concern, with numbers well below 50% (Holbrook et al., 2009; Gowans et al., 2003; Stevens et al., 2019). And, when passage at several dams is required for successful migration, the cumulative effect of even slightly reduced passage at these dams can be substantial (Holbrook et al., 2009).

The Draft EA's reference to passage success at the Milford Dam on the Penobscot River is misplaced. It ignores the serious, self-reported delays in salmon passage at Milford during tagging studies of adult passage. Specifically, the Draft EA neglects to recognize that at Milford in 2014, according to Brookfield's own data, 95% of tagged salmon that approached within 200 meters of the Milford Dam failed to pass the fish lift within the required timeframe of 48 hours.[27] The Draft EA also neglects to recognize that, again according to Brookfield's own data, 83% of the tagged adult salmon did not pass the fish lift within 48 hours in a 2015 study.[28] Similarly, the Draft EA neglects to acknowledge that University of Maine researchers also found in a 2015 study that 65% of adults did not pass the fish lift within 48 hours.[29]

These delays are biologically significant, as discussed below, and the Draft EA's failure to acknowledge them is unacceptable.

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[27] HDR Engineering. 2015. ATLANTIC SALMON PASSAGE STUDY REPORT ORONO, STILLWATER, MILFORD, WEST ENFIELD, AND MEDWAY HYDRO PROJECTS. P. 58. October. FERC Accession No. 20150324-5214.

[28] Kleinschmidt. 2016. 2015 ADULT ATLANTIC SALMON UPSTREAM PASSAGE STUDY MILFORD HYDROELECTRIC PROJECT. P. 21. May. FERC Accession No. 20160531-5663.

[29] Kleinschmidt. 2016. 2015 ADULT ATLANTIC SALMON UPSTREAM PASSAGE STUDY MILFORD HYDROELECTRIC PROJECT. P. 21. May. FERC Accession No. 20160531-5663.

ii. The biological significance of delays in upstream passage

Delays in upstream migration at dams can be extensive – up to 52 days reported by Gowans et al. (2003) – and these delays have the potential to devastate a population and erase any potential passage successes. Delays reduce survival and spawning success by increasing vulnerability to parasites and predation, depleting energy reserves, and creating missed spawning opportunities (Geist et al., 2000; Calles and Greenberg, 2009; Holbrook et al., 2009; Nyqvist et al., 2017(3); Izzo et al., 2016). The dangers of each of these possible outcomes is particularly alarming for the individuals that make up small populations, as in the case of the Kennebec's small endangered Atlantic salmon population.

Caudill et al. (2007) found that fish may ultimately be successful in passing one or more dams, but never make it to spawning grounds; this was attributable to the delayed passage at the dams. Geist et al. (2000) predicted that salmonids delayed more than five days passing each dam would have insufficient energy reserves to complete spawning, because migrating adults rely on energy reserves obtained in marine environments. When those energy reserves obtained from the marine environment are depleted by delays in reaching spawning habitat, spawning cannot be completed or is impaired because of insufficient energy reserves (Geist et al., 2000). Best current information and scientific literature also emphasizes the critical importance of repeat spawners – older, larger, repeat spawning fish are critical for population resilience and therefore recovery.[30]

[30] Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7. This communication is attached to these Comments. This current information is discussed further in Part B.v. herein.

Fungal infections in fish that failed upstream dam passage reported in Conon River in Scotland (Gowans, 2003) were attributed to combined stress of handling and accumulating with other fish below the dam. Similar results were found for steelhead trout and chinook salmon on the Columbia River associated with head burns and cranial legions (D.A. Neitzel et al., 2004).[31] Holbrook et al. (2009) observed frequent fallbacks into estuary among adults that failed to pass dams. They associated fallbacks with temperatures exceeding 22°C, suggesting the fallbacks to be a coping mechanism for thermal stress and migratory delays.

Even after substantial remediation efforts – replacing a technical fishway with a nature-like pool fishway – increased overall passage success to 97% from the 72% seen with the Denil fish pass, more fallbacks were reported by Nyqvist et al 2017(3). Fallbacks can cause lethal or sublethal injuries, delay or terminate migration or simply demand greater energy expenditure which has the potential to harm spawning success (Dauble and Mueller, 1993; Geist et al., 2000; Holbrook et al., 2009). Rubenstein found that Atlantic salmon experience extensive delays before passing the Lockwood Dam on the Kennebec. These delayed salmon lose more energy stores – compared to salmon that successfully reach cooler upstream habitat – due to the need to thermoregulate and/or seek-out coldwater refugia in order to survive the increased and prolonged exposure to higher water temperatures that exist below the dam. This additional expenditure of

[31] Likewise, injuries to delayed salmon "rescued" at the Lockwood Project (FERC No. 2574) in June of this year, are fully and vividly documented. FERC Accession No. 20210701-5242 (Attachment 1, Maine Department of Marine Resources (Jennifer Noll). June 17, 2021. Field Summary of Atlantic Salmon Stranding Rescue at Lockwood Dam.)

energy causes increased pre-spawning mortality, decreased spawning success, and increased loss of iteroparity from the population.[32]

This best available information highlights the need to take a comprehensive and holistic look at the complete hydropower system on any river and not just the impacts of one individual dam on fish passage, flows, ecological changes, etc. That detail and information is part and parcel of the "hard look" required by NEPA. The Draft EA fails that test.[33]

iii. Commission staff's selection of a 95% upstream passage standard is arbitrary.

It is further unclear why Commission staff chose a 95% upstream salmon passage rate when Brookfield itself proposed a 96% rate in its draft Species Protection Plan (SPP) for the Lockwood, Hydro-Kennebec, and Weston projects.[34] In its draft SPP, Brookfield stated:

> Although the Shawmut Project is not part of this SPP, the performance standards considered and included in this SPP are based on the reasonable expectation that the Shawmut Project will be relicensed with the fish passage facilities and measures currently proposed or prescribed. These include installation of a new upstream fish lift, improvements to the downstream fish passage facilities proposed by the Licensee, and implementation of preliminary fish passage prescriptions issued by NMFS in August 2020, including a project-specific upstream performance standard of 96% and a downstream standard of 97%.[35]

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[32] Rubenstein, S.R. Energetic impacts of delays in migrating adult Atlantic salmon. August 6, 2021 Presentation (discussed in Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7) (attached hereto).

[33] *American Rivers*, 895 F.3d at 49-50, 54-55.

[34] FERC Accession No. 20210601-5152.

[35] Kleinschmidt. 2021. SPECIES PROTECTION PLAN FOR ATLANTIC SALMON, ATLANTIC STURGEON, AND SHORTNOSE STURGEON AT THE LOCKWOOD, HYDRO-KENNEBEC, AND WESTON PROJECTS ON THE KENNEBEC RIVER, MAINE. May. P. 8-1, footnote 27. FERC Accession No. 20210601-5152.

Commission staff should clearly not recommend a lower passage standard than Brookfield itself has already said it would meet (albeit all without reliable basis), and doing so strains credulity.

But more significantly, Commission staff then assert that meeting the 96% standard might result in the need to build an additional fish lift:

> However, as we said in section 3.3.1.2, the fish lift was designed to meet a passage effectiveness standard for Atlantic salmon of 95% and our analysis shows that, while Brookfield should be able to meet this proposed standard, there is no guarantee that the new fish lift would be able to meet the higher standards specified by NMFS's prescription or recommended by Maine DMR. If Brookfield is unable to achieve the higher standards, then Brookfield would likely need to construct additional fishways such as a second fish lift to attempt to meet them.[36]

While these standards are themselves unrealistic, as noted above, within the parameters of the Commission staff's own analysis, the mathematics themselves do not meet the straight-face test: Commission staff is suggesting that a standard of 95% passage of their estimated 44 salmon per year is not meaningfully different from 96%. While the difference amounts to less than half an individual salmon (using the Draft EA's beginning estimate of 44), this difference is meaningful because of the alarmingly small numbers of the Kennebec's endangered Atlantic salmon population. This is a failure to take an honest and hard look at environmental consequences, as Commission staff's conceptual difference between what is assumed to meet a 95% standard instead of a prescribed 96% upstream salmonid passage standard finds no support in the record or in information of any professional integrity. In the end, Commission staff fail to comprehend the critical need to restore salmon to the Kennebec, one of only two major

[36] Draft EA at p. 118.

river systems, and one of just a small handful of rivers altogether, in the U.S. – all in the State of Maine – that still support wild Atlantic salmon populations. Though the NGOs support removal of Shawmut entirely, the Commission should certainly not decide the appropriate passage standards for Brookfield based on the "burdens" associated with the number of required fish lifts. FERC must base passage standards for Atlantic salmon on the needs of this endangered species and the goals for Atlantic salmon recovery in the Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*).[37]

Moreover, the Draft EA misapprehends the process of fish passage *design*. Fishways are not designed to meet a certain passage or efficiency standard, nor does a fishway meeting USFWS standards reliably guarantee a particular passage standard or efficiency. Fishways are designed for capacity – pounds of fish to be lifted or passed, the size of hoppers, the rate hoppers can complete lift cycles, the size/width of fish ladders or of pools, etc. The *efficacy* of a given design – its ability to meet a certain passage percentage of efficiency – is never guaranteed. The USFWS Fish Passage Engineering Design Criteria manual (USFWS 2019) states:

> The efficacy of any fish passage structure, device, facility, operation, or measure is highly dependent on local hydrology, target species and life stage, dam orientation, turbine operation, and myriad other site-specific considerations.[38]

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[37] U.S. Fish and Wildlife Service and NMFS. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) 74 pp.

[38] USFWS (U.S. Fish and Wildlife Service). 2019. Fish Passage Engineering Design Criteria. USFWS, Northeast Region R5, Hadley, Massachusetts at Section 1.3 p. 1-1.

Simply stating that a fishway will meet a standard does not mean that it will, and this particular fishway was not designed to meet a 95% passage standard; rather, it was designed to pass fish given the configuration of the dam and powerhouses in issue sized to pass the estimated capacity needs. NEPA analysis requires the Commission to grapple with the uncontested *uncertainty* of ever meeting a 95% or 96% salmonid upstream passage effectiveness rate at Shawmut, and the significance of the environmental consequence should that passage effectiveness rate not be met. And it must grapple with that uncertainty in light of current information, set forth above, that in truth it appears no dam in the world has ever consistently met that standard.

iv. The Draft EA ignores compounding effects and compensatory and depensatory processes.

Commission staff's evaluation of the different passage effectiveness percentages ignores the profound significance of compounding effects and compensatory processes. McElhany et al., 2000 explain the density dependent compensatory and depensatory processes that strongly influence population dynamics. When populations are small, compensatory processes act to mitigate the threats of small population size through increased productivity, creating a stabilizing effect. Therefore, the contributions of each individual in a small population is higher at small population sizes. However, when populations are depleted below critical sizes, depensatory processes occur that reduce productivity and increase likelihood of extinction through inbreeding depression and increased relative predatory pressure on each individual fish (McElhany et al., 2000). For populations depleted below critical levels like the Atlantic salmon, protecting each spawning individual may be vital to recovery of the GOM DPS. While minor losses of spawner numbers may appear insignificant in a vacuum, for a critically depleted population such as Atlantic salmon, the contributions of each spawner on the number of emerging smolts must be considered (McElhany et al., 2000; Holbrook et al., 2009). In this respect, the Draft EA's dismissal of the difference between hypothetically passing (within 48 hours of approach) 35 individuals instead of 36 is an egregious error,[39] ignoring best information on the effects of compensatory and depensatory processes on a population that is indisputably on the verge of extinction.

As established by Hutchings (2001), the longer a population is burdened by such pressures, the lower its chances are of recovering. Poor returns of spawners to upstream river segments and combined inefficiencies of fishways indicate that recolonization will be slow (Bryant et al. 1999). Opening the river for passage for spawners and ensuring the greatest potential for successful repeat spawning must be prioritized to ensure the best chance of recovery.

In its rejection of 96% and 99% performance standards for Atlantic salmon, the Draft EA presents an analysis in Table 4 of adult salmon passage above the Weston Project,[40] concluding that:

> Under a[sic] 96 and 99 percent upstream survival standards, the average number of returning salmon surviving passage through all four dams would increase to about 37 to 42 adult salmon, respectively. This would represent an increase in survival of about 5.7 percent to 20 percent over existing conditions. Maine DMR's goal for Atlantic salmon is to restore a minimum population of 2,000 adults annually to historic high-quality habitats in the Kennebec River above Weston Dam (Maine DMR, 2020a). Likewise, Commerce chose 2,000 spawners as a number that can weather downturns in survival (74 CFR 29300). Thus, the average return for 2014-2020 represent about two percent of the restoration goal of 2,000 adult salmon. Based on these existing low run sizes compared to the

[39] Draft EA at p. 40.

[40] Draft EA at p. 41.

> restoration goals, the higher performance standards stipulated by NMFS and recommended by Maine DMR would provide minimal benefits to the Atlantic salmon population at this time.[41]

This analysis casually dismisses MDMR's recommendation for an upstream passage standard that would cut losses by more than 75% of migrating adult salmon to spawning habitat caused by passage inefficiencies at the four lower Kennebec dams. It also assumes that ongoing restoration activities, including improved fish passage, will not result in increasing numbers of spawning salmon returning to the Kennebec River during the long term of a new license. Projecting increases in salmon returns that may occur as restoration efforts ramp up, the benefits of increased passage survival are obvious. With passage success at 95% at each dam, more than 18% of returning salmon are prevented from reaching spawning habitat above the Weston Dam. Increasing passage success to 99% reduces losses to less than 5%. This is shown on the following Table A (below).

Table A. Annual returns of adult Atlantic salmon to the Lockwood project, from current estimate (44) to 2,000, calculated to pass above four dams at the current rate (trucking of 79%), 95, 96 and 99% at each project.

Species	Annual Return	Baseline w/Lockwood Lift + Trucking (79%)	95% (4 dams)	96% (4 dams)	99% (4 dams)
Atlantic Salmon	44	35	36	37	42
	100	79	81	85	96
	500	395	407	425	480
	1,000	790	815	849	961
	2,000	1,580	1,629	1,699	1,921

[41] Draft EA at p. 41.

The Draft EA also errs in evaluating the benefits of fish passage solely on the current number of returning adult salmon, and assuming that it will not change over the 30+ year term of a FERC license. The current critically low number of spawners returning to the Kennebec is not surprising given that (1) restoration efforts for salmon in the Kennebec watershed are in their very early stages; and (2) restoration efforts so far have been severely hampered by the Shawmut Project and the three other dams.

v. The Draft EA's proposed operating periods for upstream passage are inadequate.

The NGO's agree with MDMR that, based on the most current information, "Atlantic salmon have been documented in the Kennebec River migrating upstream for a longer season and sea lamprey predominately migrate during the night. Fish passage should be provided from May 1 through November 10 with operations occurring 24 hours per day from May 1 through June 30 to accommodate diurnal and nocturnal migrants."[42] The Draft EA rejects MDMR's recommended operating periods for upstream passage, with no reasonable rationale provided for that rejection.

vi. The design and location of the proposed Shawmut fish lift are inadequate.

The Kennebec Coalition reasserts its comments on this issue, submitted in protest to the Shawmut license application.[43] Although an express purpose of the ISPP was to allow Brookfield to study and test methods for passing fish at Shawmut and other dams,

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[42] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project, State Water Quality Certification. July 17. P.6 This MDMR filing is attached hereto for reference.

[43] CLF, which did not join in the protest to the Shawmut Project license application, joins in those comments now.

Brookfield has done almost nothing to study this issue since the ISPP (now expired) went into effect in 2013. Brookfield has selected the location and type of fish passage facility without evidence indicating where salmon or shad downstream of Shawmut would congregate below the dam. The single study on which Brookfield has apparently based the location of its proposed fishway was a one-time release of 150 tagged alewives in 2016.[44] Such a limited study in a single year, with small numbers of just one of the five target species of anadromous fish under a limited set of flow conditions, does not come close to providing adequate data on which to base the location of fish passage that must work for multiple species across the full range of flow conditions that may occur for decades. Brookfield cannot point to any empirical evidence that the location and type of fish passage facility are appropriate for salmon and shad at Shawmut, and there is only extremely limited evidence for river herring. A similar lack of pre-construction study has had disastrous results at the Lockwood fish lift. That project does not pass shad[45] or salmon[46] adequately. With the current upstream passage rate at Lockwood of 79%, even if all other dams passed salmon at 99%, only 77% of fish returning to Lockwood would pass the Weston Project.

Moreover, Brookfield has refused to take steps to provide effective fish passage at Lockwood since the construction of the "interim" fish lift in 2006. So not only does

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[44] Kleinschmidt. 2020 Brookfield White Pine Hydro LLC. Application for New License for Major Water Power Project – Existing Dam. Shawmut Hydroelectric Project (FERC No. 2322). January 30. Pp. E-4-48-49; FERC Accession No. 20200131-5356.

[45] MDMR. Intervention letter from Commissioner Keliher to Secretary Bose, FERC (May 2, 2014) at 2 [FERC Accession No. 20140502-5080].

[46] Letter from Dan Kircheis (Acting ESA Fish Recovery Coordinator, NMFS Greater Atlantic Regional Fisheries Office) to Secretary Bose, FERC re NOAA Fisheries comments on the draft 2017 KHDG report (March 27, 2018) at 1 [FERC Accession No. 20180329-5166].

Brookfield have essentially no empirical evidence to support the construction of the Shawmut fish passage facility, but it has demonstrated at Lockwood that it would likely do nothing to remedy future fish passage failures at Shawmut.[47]

In addition, the proposed attraction flow adjacent to the fish lift entrance could create a false attraction delaying both salmon and shad passage, particularly for fish moving across the face of the dam. The fish lift design incorporates a standard design for the crowder V-gates, which have been shown at other projects to allow shad that have passed through the V-gate to then pass downstream, contrary to the design plan to contain fish prior to lifting. Regarding the "fish ladder" portion of the proposed facility, designed to move fish attracted to units 7 and 8 to the tailrace of units 1-6, the concern is that shad would have difficulty navigating the turbulent tailrace waters. There are also questions concerning the ability for fish to find the "fish ladder" entrance. The ladder is expected to pass roughly 100 cfs. Adjacent to it, the Taintor gate will pass 600 cfs for downstream fish passage. Units 7 and 8 each can pass 1,430 cfs. With both units running, the ladder will be less than 3% of flows at the fishway entrance, well below agency standards.[48]

[47] *See American Rivers*, 895 F.3d at 53 (recognizing that the Commission cannot ignore its own licensing record in determining whether a licensee will "regularly and predictably" comply with conditions). Brookfield has a license history of ignoring or delaying steps to improve fish passage conditions, when existing conditions have proven indisputably inadequate. Indeed, Brookfield allowed the interim Biological Opinion and associated incidental take authorization therein governing Shawmut to lapse on December 31, 2019, and has taken now nearly 3 years to even begin to take steps to confront that lapse. The Lockwood Project fish passage deficiencies have been known and acknowledged for over a decade.

[48] Kennebec Coalition. 2020. KENNEBEC COALITION'S MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS OPPOSING THE ISSUANCE OF A NEW LICENSE FOR THE SHAWMUT PROJECT NUMBER 2322-069, WITH RECOMMENDATION FOR ORDER OF PLAN FOR DECOMMISSIONING AND REMOVAL. Pp. 43-45. August 29. FERC Accession No. 20200831-5332.

MDMR has issued similar comments about the poor design of the proposed Shawmut upstream fish passage facility. In comments on Brookfield's application for water quality certification, MDMR stated:

> The Licensee has proposed to construct permanent upstream fish passage (a single fish lift) at the Shawmut project. Successful fishways must create hydraulic signals strong enough to attract fish to one or multiple entrances in the presence of competing flows (i.e., false attraction). The Shawmut dam is extremely long and has multiple discharge locations that will provide significant false attraction flows during the passage season. MDMR has serious concerns about the design, operation, and location of the fishway and believes the current proposal will result in significant delays and likely poor upstream passage efficiency for multiple species. MDMR also has serious concerns about the cumulative adverse impacts of the Lockwood, Hydro-Kennebec, and Weston projects, which has similar issues.
>
> MDMR is very concerned about the effectiveness of the proposed fishway in May, June, and July when the majority of anadromous species are migrating upstream (Table 1). The maximum station hydraulic capacity of the Shawmut Project is 6,690 cfs, which is exceeded approximately 65% of the time in May, 35% of the time in June, and 20% of the time in July. Water in excess of station capacity is spilled at the sluice gate in the middle of the 1,435-foot long dam, the hinged flashboards on the west side of the dam, or the rubber crest(s) on the eastern half of the dam, providing multiple false attractions. As a result, there will be false attraction at the project during the majority of the upstream migration season to multiple areas without a fishway to the headpond. A proposed cross channel egress from an identified false attraction zone would not provide passage to the headpond or directly to the lift.
>
> The location of the fishway was based on very speculative assumptions using limited information. The CFD modeling that was conducted looked at a very limited range of flows that are not representative of the majority of the migration period. Furthermore, the siting study, conducted from May 19-June 14, 2016 with radio-tagged alewife, occurred during a low flow period, which is not representative of flows during the passage season. Alewives are not necessarily a good proxy for fish attraction of other species, as the Lockwood and Brunswick projects demonstrate. The existing American Eel fishway locations were selected based on flow conditions that will be changing based on the proposal.[49]

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[49] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project, State Water Quality Certification.. P.5. July 17. (Note: Not submitted to FERC so we may have to attach)

The consequences of multiple discharge locations and false attraction are well illustrated at the Lockwood Dam, where false attraction to the bypass channel, combined with annual fluctuations in station discharge caused by flashboard installation, require a "fish rescue" every time flashboards are installed. According to MDMR, in 2021 this event resulted in at least three adult Atlantic salmon becoming stranded in isolated pools in the Lockwood bypass channel. One of these salmon captured and trucked upstream suffered extensive injuries, including "scraped up body dorsally, scraped up sides (both left and right), an abrasion ventrally, a bruise on its left side, a lamprey wound scar on its right side, a split dorsal fin, a split caudal fin and a bruised snout."[50] At least two other adult Atlantic salmon, one with "significant scars located dorsally on its body"[51] were also trapped during this event, but could not be captured and transported. In 2021, three endangered Atlantic salmon (compared to 15 that had been trapped and trucked from the Lockwood Dam fish lift as of August 9, 2021[52]) were subjected to this stress—two with significant injuries. That is 17% of total salmon returns to the Kennebec—at just a single dam. The future suggested by this Draft EA would include similar inefficiencies at four dams, before endangered salmon reach spawning habitat in the Sandy River. The impacts of these inefficiencies and injuries are not evaluated or even acknowledged in the Draft EA.

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[50] MDMR (Jennifer Noll). June 17, 2021. Field Summary of Atlantic Salmon Stranding Rescue at Lockwood Dam. (This report was included as Attachment 1 to a filing about the event by Trout Unlimited submitted on July 1, 2021: FERC Accession No. 20210701-5242.)

[51] Ibid.

[52] Maine Department of Marine Resources "Recent Trap Counts for Fish Returns to Maine by River," accessed at https://www.maine.gov/dmr/science-research/searun/programs/trapcounts.html on 8/11/2021.

All told, the Draft EA does nothing to confront or "grapple with" the opposing views.[53] In conducting its NEPA analysis, the Commission "cannot overlook a single environmental consequence even if it is 'arguably significant.'"[54] It must "comply with NEPA's exacting procedural requirements to 'to the fullest extent possible.'"[55] This Draft EA fails that test.

B. The Failure to take a "Hard Look" at Downstream Fish Passage Performance Standards

The Draft EA's analysis of a downstream salmon passage standard has many flaws. "Put simply, an agency's [EA] 'must give a realistic evaluation of the total impacts and cannot isolate a proposed project, viewing it in a vacuum.'"[56] Unfortunately, that is exactly the analytical flaw of the Draft EA, and as such it cannot stand.

i. Both a 96% downstream passage at Shawmut and an overall 4-dam passage survival rate of 88.5% are unrealistic and unattainable.

Brookfield's own data show that 96% downstream passage is not attainable at the Shawmut Project, and neither is an overall survival rate of 88.5% over all four of the Kennebec dams. On behalf of the Kennebec Coalition, Don Pugh, a fish passage expert with decades of experience at the S.O. Conte Anadromous Fish Research Center,[57] evaluated Brookfield's downstream smolt passage data from 2012 to 2015 and identified two key factors that inflated smolt survival percentages.

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[53] *American Rivers*, 895 F.3d at 49 & 51.

[54] *Id*. (quoting *Myersville Citizens for a Rural Cmty., Inc. v. FERC*, 783 F.3d 1301, 1322 (D.C. Cir. 2015)).

[55] *Id*. (citing *Delaware Riverkeeper Network v. FERC*, 753 F.3d 1304, 1310 (D.C. Cir. 2014)).

[56] *Id*. (quoting *Grand Canyon Trust v. FAA*, 290 F.3d 339, 342 (D.C. Cir. 2002)).

[57] Mr. Pugh's curriculum vitae is attached to these Comments.

First, Normandeau (Brookfield's consultant) inappropriately used paired release studies when analyzing the 2013 to 2015 data; paired release studies should only be used when there are at least 1000 fish. Using this methodology with the small numbers of Atlantic salmon smolts in the Kennebec, as Brookfield's consultant did, actually "creates fish" statistically, with calculated survival rates exceeding the number of fish that actually survived.[58] The Draft EA ignores this significant flaw in Normandeau's analysis.[59]

Second, Brookfield inappropriately calculated overall downstream survival rates as the product of survival rates at each individual dam, which leaves out the highly significant impacts of the impoundments between the dams.[60] Mr. Pugh analyzed the actual survival of individual smolts from 200 meters above the Weston Dam to the lowermost telemetry station below the Lockwood Dam. Only an average of 56% of smolts survived this multi-dam passage over the course of the four years of the Normandeau studies.[61] This is likely an overestimate of survival because Normandeau released smolts just above the Weston Dam, excluding the likely significant impacts on smolt survival of the long Weston impoundment, which is approximately 12 miles long. Based on Mr. Pugh's calculations, Brookfield's contention that it can meet an "end-of-

[58] Kennebec Coalition. 2020. MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS OPPOSING THE ISSUANCE OF A NEW LICENSE FOR THE SHAWMUT PROJECT NUMBER 2322-069, WITH RECOMMENDATION FOR ORDER OF PLAN FOR DECOMMISSIONING AND REMOVAL. P. 41. FERC Accession No. 20200831-5332.

[59] *Id*.

[60] See also, Part B.iv., herein, discussing best available information on the additional significant issue of delayed and estuarine mortality. This critical information is also relevant to this discussion.

[61] Kennebec Coalition. 2020. MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS OPPOSING THE ISSUANCE OF A NEW LICENSE FOR THE SHAWMUT PROJECT NUMBER 2322-069, WITH RECOMMENDATION FOR ORDER OF PLAN FOR DECOMMISSIONING AND REMOVAL. P. 38. FERC Accession No. 20200831-5332

pipe" downstream passage goal of 88.5% is both absurd and perilous for the future of the endangered Atlantic salmon.

Similarly, Mr. Pugh's analysis showed that average survival at the Shawmut dam between 2013 and 2015 was 78.3%, not the 93.9% that appears to have been accepted in the Draft EA.[62] It is extremely unlikely that any measures that Brookfield proposed in its license application could increase downstream survival to 93.9%, let alone 96%, as discussed below.

Throughout the Draft EA, downstream passage survival numbers referenced are the paired release "baseline" numbers from Brookfield's annual diadromous fish reports for 2013 to 2015. In order to understand the effect of a 24-hour downstream passage requirement, Brookfield included a paired release analysis of downstream survival that considered fish that did not pass within 24 hours as mortalities. These results are called 'adjusted'. Table B (below) compares the baseline (all fish that passed) and adjusted results for the years 2013 to 2015.

Table B. Comparison of baseline and adjusted survivals for Weston, Shawmut, Hydro-Kennebec, and Lockwood projects by year and averaged.

	Weston		Shawmut		Hydro-Kennebec		Lockwood	
Year	Base	Adj	Base	Adj	Base	Adj	Base	Adj
2013	95.7	79.7	96.3	83.2	94.1	88.1	100	93.7
2014	89.5	86.4	93.6	88.5	98.0	90.0	97.7	94.6
2015	99.7	66.0	90.6	83.8	n/a	n/a	98.0	88.8
Mean	95.0	77.4	93.5	85.2	96.1	89.1	98.6	92.4

When fish that did not pass within 24 hours are considered mortalities, **even with** a paired release analysis, survival is far below the 96% downstream bypass standard of

[62] Draft EA at p. 52.

Brookfield's ISPP, ranging from 3.6% to 18.6% lower than the standard. As noted above, these are survivals for fish passing only one dam and do not consider the effect of passing four dams, as wild smolts must, or of the effect of passing approximately 27 miles of impounded river (which is 86% of the river from the head of the Weston impoundment to the Lockwood project).

The impact of passing multiple dams can be seen in the numbers of fish that were released above Weston, and in the Weston tailrace, that passed Lockwood in 2014 and 2015 (Normandeau 2015 & Normandeau 2016, Report Tables 7-4 and 6-4 respectively). Of the 158 fish (98 above pass four dams; and 60 below pass three dams) released at the Weston project in 2015, only 100 were detected below Lockwood (63.3%). In 2014 with similar numbers above and below Weston, 81.8% of the fish released at Weston were detected below Lockwood for a two-year average of only 72.6%. Survival to below Lockwood of fish released at Weston, Shawmut, Hydro-Kennebec, and Lockwood in 2014 of 81.8%, 86.9%, 94.1% and 99.0% clearly reveal the effect of passing multiple dams (Report Table 7-7, Normandeau 2015): Survival decreases as the number of dams passed increases (*see also* Stich et al. 2015).

Commission staff's analysis also fails to even consider delayed mortality of smolts that survive immediate passage at each dam, but suffer increased mortality as they continue their migration beyond the immediate tailrace. Research on the Penobscot River assessing survival of tagged smolts found that the number of dams passed by a salmon smolt had a "strong negative effect of fish survival in the estuary."[63] Building on these empirical results, Stevens et al. modeled salmon smolt survival through multiple

[63] Stich et al. 2015 at pp. 68-86.

Penobscot River dams and showed a clear negative correlation between predicted smolt survival and the number of dams encountered, concluding that "up to 37% of the annual loss of hatchery smolts was attributed directly to dams."[64] They also analyzed the increase in survival from the Penobscot River Restoration Project, which removed the lowest dams on the Penobscot River, and concluded that "a 36% increase (from unrestored) in wild smolt survival to the ocean was possible with the removal of some dams in the Penobscot River."[65]

An analysis of survival that only considers the immediate impact of each dam individually is inadequate and misleading when analyzing the impact of the multiple projects on smolt survival. And it bears repeating that NEPA requires that "an agency's [EA] 'must give a realistic evaluation of the total impacts and cannot isolate a proposed project, viewing it in a vacuum.'"[66]

ii. Brookfield's proposed "improvements" to downstream fish passage at Shawmut are not sufficient to increase downstream survival to 96%.

As set forth in the comments of MDMR on Brookfield's State water quality certification application:

> The Licensee proposes to utilize three gates in the forebay area (Sluice Gate, Tainter Gate, and Deep Gate) and up to four sections of hinged flashboards to pass fish downstream. The licensee also proposes a guidance boom (discussed below) and no screening protection of fish through the Francis Turbines. Unlike the Licensee proposal in the SPP for the Lockwood, Hydro-Kennebec, and Weston projects, the Licensee does not propose any specific low flow thresholds that would require curtailment of generation to provide for additional spill for

[64] Stevens et al. 2019 at pp. 1795–1807.

[65] Ibid.

[66] *American Rivers*, 895 F.3d at 55 (quoting *Grand Canyon Trust v. FAA*, 290 F.3d 339, 342 (D.C. Cir. 2002)).

protection of downstream passage of Atlantic salmon smolts. The proposal also fails to provide adequate protection for other species during their period of downstream passage. The proposed downstream operational facilities are inadequate to safely and effectively pass Atlantic salmon and all species downstream…

The Licensee proposed to construct a fish guidance boom system that is intended to preclude downstream migrating fish from entrainment in Units 7 and 8. MDMR does not support the Licensee's proposal to use surface guidance booms at the Shawmut Project and finds them to be inadequate to protect the GOM DPS population of Atlantic Salmon and the other diadromous species in the Kennebec River. Data provided by the Licensee in the (SPP, Table 5-1) demonstrates that the guidance booms used at the Lockwood, Hydro-Kennebec, and Weston Projects do not guide 14.3-30.6% of the migrating smolts away from the turbines. Data provided by the Licensee (FLA, Table 4-22) shows that 32.7% of the downstream migrating smolts were entrained into the turbines at the Shawmut Project. The instantaneous survival was 7% lower when fish went through the turbines compared to spill routes at Shawmut and that grossly underestimates the sublethal effects, including injury and disorientation, that would result in higher mortality in the estuary. Studies at the Ellsworth dam on the Union River assessing injury to salmon showed that 22-30% of fish that went through the turbines had injuries compared to 3.8% that went through spill routes, demonstrating that impact quantitatively. The 2015 *Evaluation of Downstream Passage for Adult and Juvenile River Herring* demonstrated that 53 percent of the study fish went through the Lockwood turbines, rather than being guided by the boom to the downstream bypass, and survival was lowest for those fish passing Lockwood via the units (i.e., 77.4% – 81.7% survival). This would indicate that performance standards would not likely be met for these species with the proposed plan…

In addition, MDMR has consulted with the USFWS regarding floating guidance booms and concurs with their comments that are provided below.

> The Service does not know of any studies that have assessed how effective floating guidance booms are at protecting eels as they attempt to migrate downstream past a hydroelectric project. However, we do know that eels are a bottom-oriented species (Brown et al. 2009) and therefore a floating guidance boom with partial depth panels would not be fully protective. As stated in our 2019 Fish Passage Engineering Design Criteria manual, "A floating guidance system for downstream fish passage is constructed as a series of partial depth panels or screens anchored across a river channel, reservoir, or power canal. These structures are designed for pelagic fish which commonly approach the guidance system near the upper levels of the water column. While full-depth guidance systems are strongly preferred, partial-depth guidance systems may be acceptable at some sites (e.g., for protection of salmonids, but not eels)." Booms have not been

> implemented as a protective measure for eels or alosines anywhere else in our region, which spans fourteen states, unless they are installed with other protective measures that are suitable to ensure the safe, timely, and effective downstream passage of our trust species (e.g., inclined bar screens, angled bar racks, etc.). Therefore, the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects, as part of the current SPP process, are protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines.[67]

Similarly, Brookfield's and Commission staff's screening proposals are also inadequate.

According to MDMR:

> The licensee did not propose any additional screening, however FERC has suggested screening may be required as this was suggested in NMFS Section 18 preliminary prescription. The preliminary screening suggestion is to equip each powerhouse with full-depth trash rack bars clear spaced at 1.5-inches and 3.5-inches for Units 1-6 and 7-8 respectively. This screening approach is inadequate for Atlantic salmon and does not take into account juvenile river herring, shad, sea-lamprey, or eels so will not result in safe downstream passage of indigenous species. In order to protect downstream migrating Atlantic Salmon smolts and kelts, adult and juvenile Alewife, adult and juvenile American Shad, adult and juvenile Blueback Herring, and adult American Eel, and adult and juvenile sea-lamprey, the Licensee would need to install full-depth inclined or angled screening with much smaller spacing and sized so that the normal velocities should not exceed 2 feet per second measured at an upstream location where velocities are not influenced by the local acceleration around the guidance structures.[68]

It is worth noting that the USFWS has prescribed 0.75-inch inclined screening for downstream eel passage at the Pejebscot Project in Maine.[69]

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[67] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project, State Water Quality Certification. July 17. pp. 8-9. This document is attached to these Comments.

[68] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project, State Water Quality Certification. July 17. p. 10. (attached to these Comments).

[69] USFWS. 2021. COMMENTS, RECOMMENDATIONS, PRESCRIPTIONS Application Ready for Environmental Analysis Pejepscot Hydroelectric Project, FERC No. 4748-106 Androscoggin River, Androscoggin, Cumberland, and Sagadahoc Counties, ME. P. 14. July 17. FERC Accession Number 20210617-5028.

iii. The Draft EA's proposed operating period and unit prioritization for downstream fish passage are inadequate.

MDMR's comments regarding operation of the downstream fishway as proposed by Brookfield in its application for state water quality certification are also relevant to most of Commission staff's and Brookfield's proposals. Brookfield proposes to operate the downstream fishway as follows:

> The Licensee proposed to operate the downstream fishway as follows:
>
> - Continue to operate the existing forebay surface sluice gate at maximum capacity to pass up to 35 cfs from April 1 to December 31 to provide a continuous surface bypass route for downstream migrating fish;
> - Continue to spill 600 cfs through the existing forebay Tainter gate from April 1 to June 15 to provide a passage route for Atlantic salmon smolts;
> - Continue to provide a total of 6% of Station Unit Flow (about 400 cfs at maximum generation) through the combined discharge of the forebay Tainter and surface sluice gates from November 1 to December 31 to provide a safe passage route for Atlantic salmon kelts;
> - During the interim period between license issuance and the installation of the new fish guidance boom, continue to lower four sections of hinged flashboards to pass 560 cfs via spill from April 1 to June 15 to provide a safe passage route for Atlantic salmon smolts; and.
> - Continue to pass approximately 425 cfs through the forebay deep gate and shut down Units 7 and 8 for 8 hours during the night for 6 weeks between September 15 and November 15 for downstream adult eel passage [Note: FERC recommends shut downs for units 7 and 8 from August 15 to October 31].
>
> This proposed downstream operational period is inadequate to safely and effectively pass all species downstream. Alewives and blueback herring leave the spawning grounds immediately after spawning and begin their downstream migration. American shad exhibit similar behavior. This downstream migration typically occurs between May and September each year. In addition, juvenile lifestages of these three species of alosines begin migrating downstream as early as July when they are only approximately 40mm long. Larger juveniles will migrate downstream as late as November depending on environmental variables

> [and] freshwater nursery habitats. The Licensee has proposed to cease operation of the forebay Tainter gate after June 15, which would leave only the forebay sluice gate in operation. The maximum capacity of the sluice gate is approximately 35cfs, which is 0.52% of station capacity and is 0.43-0.81% of average flow at the Shawmut dam between June and September.
>
> Brookfield also mentions prioritizing units for protection of Atlantic salmon. Based on the average daily inflow reported in Table 2 of the Draft EA, station capacity will be exceeded in all months except July, August, and September. Therefore, station capacity will be exceeded at the project for the majority of the downstream migration of Atlantic salmon smolts and adult alosines in the spring and the majority of the juvenile alosines and adult eels in the summer and fall. While unit prioritization is proposed for these times as a protective measure, the prioritization will not be in effect as all units will be "on".[70]

In addition, Table 6 of the Draft EA[71] lists the percent survival through each passage route at the Shawmut Project from telemetry studies done in 2013, 2014 and 2015. Passage through the hinged flashboards is the lowest of any route. The Commission staff alternative[72] recommends that until the new guidance boom is constructed, the hinged flash boards should continue to be used as downstream passage. As this route has the lowest survival – more than 5% lower than any other route – continuing to pass out-migrating smolts through the hinged flashboards does not make sense.

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[70] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322). Hydroelectric Project, State Water Quality Certification. July 17. p. 9 (attached to these Comments).

[71] Draft EA at p. 51.

[72] Draft EA at p. 16.

iv. Best available information and scientific literature do not support attainability of these downstream passage standards.

A meta-analysis of downstream passage studies at hydropower dams in temperate regions revealed extensive fish injury as well as immediate and delayed mortality (Alegra et al., 2020). Smolt mortality is commonly reported to be substantially heightened at dams compared to free-flowing river stretches (Calles and Greenberg, 2009; Norrgård et al., 2012; Stich et al., 2015(17); Nyqvist et al., 2017(2); Alegra et al.; 2020). Direct mortality at dams is also frequently underestimated, as dead smolts are difficult to catch and can be carried downstream by drift or scavengers (Keefer et al., 2012; Havn et al., 2013).

Stich et al. (2014) reported remarkably high smolt survival of 91% at Milford Dam. However, Milford Dam has Kaplan runners rather than the Francis runners found at the Shawmut Dam, the former of which are reported in the literature to be significantly less harmful to passing fish (Calles and Greenberg, 2009; Alegra et al., 2020). Therefore, comparisons between the downstream passage rates at the Milford Dam and what is proposed for the Shawmut Dam are not meaningful and, in fact, inflate Brookfield's claims for future successes at Shawmut.

Similarly, smaller trash racks and priority operation of generators proposed by Brookfield would not effectively protect downstream migrating smolts. Current priority operation of generators has not achieved proposed passage standards for smolts, and the proposed trash racks would not exclude smolt from entrainment.

The Draft EA fails to adequately evaluate the overall impacts of hydropower operations and resulting delayed mortality on fish. Rapid pressure changes and high probabilities of striking through turbines and high concentrations of dissolved gas below spillways significantly reduce fitness and increase fish vulnerability to predation by impairing swimming and sensory functions necessary to detect and avoid predators (Johnson et al., 2005; Ferguson et al., 2006; Norgarrd et al., 2012). Indirect mortality is not accounted for in the scope of most passage studies, but most recognize it as a basic caveat to their research (Budy et al., 2002; Ferguson et al., 2006; Norgarrd et al., 2012; Stich et al. 2014; Stich et al,. 2015; Alegra et al., 2020).

Alegra et al. (2020) found 81% of data sets that evaluated fish injury at dams reported higher likelihood of injury than controls, 63% of which were significant. Stich et al. 2015 attributed a 6-7% reduction in estuarine smolt survival for each dam passed along their downstream migration. They reported greater indirect dam-related estuarine mortality than direct passage mortality reported at dams on the Penobscot River. Schaller et al. (2014) related the marine mortality of 76% of out-migrating smolts that had survived passage in the Columbia River Power System to their outmigration experience, and positively related delayed mortality to the number of powerhouse passages. Ferguson et al (2006) demonstrated delayed mortality by comparing survival of balloon-tagged and radio-tagged smolts at various distances downstream dams. They attributed 46-70% of total estimated mortality in radio-tagged fish to delayed mortality.

In addition to threats imposed by powerhouse passage, smolts are vulnerable to delays at dams. Successful migration can be critically dependent on the synchronization of numerous confounding factors (McCormick et al., 1998; National Research Council, 2004). Successful smoltification is physically, behaviorally, and environmentally constrained in time. Delays can occur approaching dams due to the transition from passive to active swimming at the impoundment, thermal stress, and difficulty finding confined passage entrances. They reduce fitness and survival through increased exposure to predation and parasites, reduced feeding opportunities, and desmoltification (Mccormick et al., 1998; Keefer et al., 2012).

Even where direct survival has been improved through technological enhancements, impacted stocks continue to decline. Several reports evaluating salmon population viability in the presence of dams recommend that breaching lower dams was the most likely management option to achieve recovery (National Research Council, 2004; Budy et al., 2002; Lawrence et al., 2016).[73]

The Draft EA's analysis of downstream smolt survival shows clearly that improved passage success at each dam in a river containing four dams has a dramatic impact on smolt survival, such that improving downstream passage success even from 96% to 99% increases smolt survival through the 50.1 km length of the Kennebec River from the mouth of the Sandy River to the base of Lockwood Dam, from 13,187 to 14,941 individuals.[74] As was the case when evaluating the benefits of improved upstream passage for salmon, set forth in Part A herein, the Draft EA's analysis and discussion of Atlantic salmon smolt losses as they pass over and through multiple dams ignores the obvious: the presence of multiple dams substantially decreases smolt survival. This is clear in the following paragraph from the Draft EA:

> Brookfield's downstream survival studies indicate that whole station survival of juvenile salmon through the Shawmut Project has never consistently exceeded 96%; its passage efforts have resulted in an average survival rate of 93.9% under existing conditions. Therefore, Brookfield's proposed, NMFS's prescribed, and Maine DMR's recommended survival standards would represent an increase in

[73] See also Part D.ii, herein, discussing the 2019 Final Recovery Plan for Atlantic salmon, prioritizing dam removal as the key Recovery Action therein.

[74] Draft EA at p. 59.

> juvenile salmon passage survival through the project of 2.1, 3.1, and 5.1 percentage points, respectively. However, neither NMFS nor Maine DMR demonstrated how the higher survival standards would benefit the downstream migrating Atlantic salmon smolt population. To compare these survival standards, we used an initial population of 18,420 smolts migrating downstream from the mouth of the Sandy River through all four dams. Based on a natural freshwater mortality rate of 0.33% of smolts per kilometer (Stevens et al., 2019), the population potentially surviving below Lockwood Dam using a 96, 97, and 99 percent survival standard would be 13,187 smolts, 13,745 smolts, and 14,914 smolts, respectively. When accounting for estimates of estuarine mortality (1.15% per kilometer) based on Stevens et. al. (2019) and marine survival of smolts (0.4%) based on NMFS (2013), the number of adult salmon returning to Lockwood Dam under a 96, 97, and 99% downstream smolt survival standard would be 24, 25, and 27 adults, respectively. Thus, the incremental gains in survival rates of 1 and 3 percentage points that would accrue through NMFS's prescribed and Maine DMR's recommended performance standards, respectively, would be negligible.[75]

The Draft EA does not show how those estimates of smolt survival were generated, but the conclusion that the benefits of improved survival of smolts at dams are "negligible" hides the clear increases behind a tortured analysis that expresses the benefits only in terms of a modeled increase in the existing very low adult returns. Even accepting the analysis on its face, increasing downstream passage success increases adult returns from 24 to 27—a 12.5% improvement. With salmon on the brink of extinction, 12.5% is a significant gain. This benefit is much clearer if evaluated on the basis of the number of salmon smolts killed as they pass the four dams, and how this number changes with improved passage efficiency. The Draft EA does not show these numbers, but they can be calculated using the smolt survival numbers provided in the Draft EA analysis. The table below (Table C) shows estimates of the total number of smolts leaving the mouth of the Sandy River (18,420), and the number of surviving smolts at the base of the Lockwood Dam, accounting for (1) natural mortality as the smolts migrate the 50.1 km

[75] Draft EA at p. 59.

from the Sandy River to below Lockwood Dam and (2) for smolt mortality due to passage inefficiencies at dams. Commission staff's calculation is that with 96%, 97%, and 99% passage efficiency, smolt survival will be 13,187, 13,745, and 14,914, respectively. Simple subtraction shows that with 96% passage, smolt mortality is 5,233; with 97% passage 4,695; and with 99% passage 3,506. Improving passage efficiency from 96% to 99% reduces smolt mortality by 1,727—a 33% reduction in overall smolt mortality.

The Draft EA does not show natural mortality and mortality at dams separately, but the relatively high rate of natural mortality it assumes obscures the benefits of improving downstream fish passage. The Draft EA used an estimate of 0.33% mortality of smolts per river-km to calculate "natural freshwater mortality." A mortality rate of 18,420 smolts over 50.1 kilometers of river generates a calculated natural mortality for this reach of 3,045, and we assume it to be the same for each passage efficiency scenario. Subtracting this estimate of natural mortality from the Draft EA's estimate of total smolt mortality, we can isolate the smolt mortalities caused by the dams: 2,188 smolts with 96% passage; 1,630 smolts with 97% passage; and 461 smolts with 99% passage. Increasing passage success from 96% to 99% reduces mortality of Kennebec River smolts at dams from 2,188 to 461, and the rate of smolt mortality at dams from 11.9% to 2.5%. The reduction in smolt mortality at dams from improved downstream passage is 79%.

Table C. FERC estimates of cumulative smolt survival at dams and in free flowing reaches at 96%, 97%, and 99% downstream survival at four dams, smolt losses at dams and a combined total percent mortality.

	Smolts from Sandy River	FERC Calculation of Smolts Surviving to Base of Lockwood Dam	Total Smolt Mortality	FERC Estimate of Natural Freshwater Smolt Mortality (0.33%/km; 50.1 km)	Smolt Losses at Dams	% Smolt Mortality Due to Dams
96% DS Passage Success	18,420	13,187	5,233	3,045	2,188	11.9%
97% DS Passage Success	18420	13,745	4,675	3,045	1,630	8.8%
99% DS Passage Success	18420	14,914	3,506	3,045	461	2.5%

Incredibly, it is this reduction of 79% mortality for Atlantic salmon smolts in their downstream migration that the Draft EA characterizes as "negligible."

In addition, although the Draft EA cites Stevens et al, 2019 for estimates of freshwater and estuarine smolt mortality per river kilometer, it ignores that paper's conclusion that estuarine survival of Atlantic salmon smolts is significantly reduced by passage over hydropower dams. In their model, Stevens et al. estimate estuarine survival is 87.2% for smolts passing no hydropower dams; reduced to 67.7% for smolts passing even a single hydropower dam; and is 56.2% for smolts passing over four hydropower dams. Stevens et al. make a number of very strong statements about this:

> The latent impacts of dam passage and subsequent delayed mortality in estuaries has been investigated in Pacific salmon (Budy et al. 2002; Schaller et al. 2014; Haeseker et al. 2012; Rechisky et al. 2013), with all but Rechisky et al. (2013) concluding significant negative effects. Stich et al. (2015*b*) demonstrated the first evidence of latent estuary mortality in Atlantic salmon. The difference in estuary survival with one dam (68%) to zero dam (89%) exposure in our reference studies (Stich et al. 2015*b*; NOAA, unpublished data) strongly suggests that important delayed mortality may occur even with only one dam. However, with a rate of

> change of approximately 6% increase per dam (Stich et al. 2015*b*), the overall dam-induced latent estuary mortality is especially problematic for production areas or stocking sites above multiple dams.[76]

The Draft EA's failure to analyze or even acknowledge the issue of delayed mortality significantly undercuts the conclusion that Shawmut Project's impacts on endangered Atlantic salmon are not significant. In conducting its NEPA analysis, the Commission "cannot overlook a single environmental consequence even if it is 'arguably significant.'"[77] In doing so with respect to the issue of delayed mortality, the Draft EA commits the same category of reversible error that was present in the *American Rivers* case, where the environmental consequence that the Commission missed was the ineluctable reality that, with respect to fish passage, "[t]he Project would compound the death rate."[78] "Those fish that manage to run the gauntlet of youth and natural mortality factors will now emerge only to face hydropower turbines and *other lethal aspects* of the Project."[79] In sum, "[t]he Commission's NEPA analysis has to grapple with that," and has to do so "honestly" and under a "hard look."[80] It fails by all measures.

v. The Draft EA fails to contain or even analyze passage standards for downstream-migrating adults (kelts), and ignores the significance of repeat spawners.

The Draft EA contains no passage standards for Atlantic salmon kelts. Best available information and scientific literature emphasizes the unique importance of repeat

[76] Stevens et al. 2019 at p. 1804.

[77] *American Rivers*, 895 F.3d at 51 (citing *Myersville Citizens for a Rural Cmty., Inc. v. FERC*, 783 F.3d 1301, 1322 (D.C. Cir. 2015)).

[78] *Id*.

[79] *Id*. (italics emphasis added).

[80] *Id*. at 51 & 49.

spawners, and the difficulty in passing kelts. This is an environmental consequence that, under NEPA, cannot be ignored.

Standards for kelts need to be considered and prioritized in order to promote recovery; without this consideration recovery plans are not adequate and will likely fail. Research indicates that downstream-migrating adult salmon follow bulk flows (Coutant and Whitney, 2000). However, even with fishways and high flow through spillways, many kelts have been observed passing through turbines, resulting in low downstream passage survival (Calles and Greenberg 2009; Nyqvist et al., 2017(8). Survival through multiple dams compared to that in free-flowing rivers is dismal (Coutant and Whitney, 2000; Wertheimer and Evans, 2005; Holbrook et al., 2009; Norrgård et al., 2012; Nyqvist et al., 2016). The positive contributions kelts were found to make towards population persistence diminished with the presence of multiple dams (Lawrence et al., 2016). Consideration of passage effectiveness rates for kelts is therefore an imperative component of a successful restoration plan.

Repeat spawners are a particularly critical factor necessary for the recovery of Atlantic salmon populations because their populations are small and recovering (Nyqvist et al., 2016; Bordeleau et al., 2020), as is especially the case for the GOM DPS. These individuals have been shown to contribute substantial numbers of offspring while providing a stabilizing effect on populations. Repeat spawners often have higher fecundity than first time spawners, given the repeat spawners' greater size and experience (Halttunen, 2011; Maynard et al., 2018; Baktoft et al., 2020). Variation in the timing of spawning among year-classes diffuses the adverse effects of environmental variability on spawning success and promotes genetic diversity within populations (Saunders and

Schom, 1985; Moore et al., 2014). A model developed by Lawrence et al. (2016) revealed that the abundance of kelts was positively related to the probability of population persistence. Thus, the loss of just a few individual repeat spawners through passage-related mortalities each season has a qualitatively greater impact on the ability of the species to avoid extinction.

Declining numbers of repeat spawners have been widely reported (Hubley et al., 2008, Nyqvist et al., 2016; Maynard et al., 2018) and associated with overharvesting and hydropower projects (Wertheimer and Evans, 2005; Keefer et al., 2008). The proportion of repeat spawners in the Penobscot River's Atlantic salmon run over the last decade has averaged 0.04%, compared to an average of 1.7% in the 1980s (Fleming and Reynolds, 2004). Average proportions of repeat spawners in the southern North American range of Atlantic salmon have decreased significantly from 4.1 to 2.7% (Bordeleau et al., 2020). Though many northern and mid-latitude populations have exhibited a relative increase in repeat spawners with reductions in fishing pressure, declines seen in the southern range have been attributed to anthropogenic threats such as hydropower projects and reliance on hatchery reared fish (Maynard et al., 2018). Hydropower projects elevate mortality of post-spawners during downstream migration through injuries and delays (Holbrook, 2009; Östergren and Rivinoja, 2008; Ferguson, 2005; Scruton et al, 2007; Kraabøl et al., 2009). Chaput and Jones (2006) highlighted the effects of hydropower projects on repeat spawners by revealing a 4.1% reduction in their prevalence between two proximate populations in the Saint John River above and below the Mactaquac Dam. Size-dependent selection against larger fish reported at passage facilities on the Penobscot and Saint John rivers may limit the persistence of repeat spawners and must be closely examined before building new passage facilities to minimize post-spawning mortality (Maynard et al., 2017; Bordeleau et al., 2020). Furthermore, delays at dams can lead to starvation, accumulated stress, increased predation and loss of marine adaptations, lowering the chances of surviving to feeding grounds (Nyqvist et al., 2016).

Recent data from researchers at the University of Maine support all of the above concerns about negative dam impacts on critically important repeat spawners and specifically show that a four-dam system would result in a loss of more than 50% of pre-spawn and post-spawn fish. In an email to the Kennebec Coalition describing work with graduate student Sarah Rubenstein, University of Maine Professor Joseph Zydlewski stated:

> 1) ATS [Atlantic salmon] face poor passage at some dams (e.g. Lockwood)
>
> 2) If passing, ATS often face long delays, usually weeks in length - sometimes months
>
> 3) Because of the high and rising downstream temperatures in lower rivers in the summer during river entry and migration, there is increased metabolic cost and this is directly related to depletion of limited and fixed energy stores.
>
> 4) Our bioenergetic model suggests that these delays significantly lower the probability of spawning success (depletion of energy stores prior to spawning likely leading to mortalities) and biologically significant declines in the probability of repeat spawning (due to energy depletion and likely mortality). For a four dam system, this loss is estimated to be greater than 50% loss for pre-spawn and post-spawn fish. These are likely conservative estimates as delays at dams are associated with increases in searching behavior, and activity means more energy demand.
>
> 5) Extensive literature suggests that older, larger, repeat spawning fish are critical for population resilience, and hence recovery (see attached).[81] In the Penobscot River (see Maynard et al., 2018) repeat

[81] Dr. Zydlewski is referring to the following paper attached to his email cited below: Hixon, M.A., Johnson, D.W. and Sogard, S.M., 2014. BOFFFFs: on the importance of conserving old-growth age structure in fishery populations. *ICES Journal of Marine Science*, *71*(8), pp.2171-2185.

> spawning is less than 1%, far less than occurs in un-dammed ATS rivers. This fact provided direct evidence that dams are associated with and likely causal to low survival (increased mortality) of post spawn salmon and underscored the demographic fragility resulting from this persistent fixed source of mortality.[82]

For all these reasons, the Draft EA's failure to even analyze the environmental consequences of downstream passage for kelts, and its failure to set passage performance standards to address the unique importance of kelt passage, fails to adhere to NEPA's "exacting procedural requirements" and to analyze the environmental consequences the Shawmut Project "to the fullest extent possible."[83]

C. The Draft EA Fails to include Alosines in Fish Passage Analysis and to take a "Hard Look" at the Environmental Consequences of Ineffective Passage of Other Species

The Federal Power Act requires the Commission to give equal consideration to fish and wildlife resources in addition to power generation.[84] NEPA requires the Commission to "integrate" its environmental impact analyses with all "related surveys and studies required by all other Federal environmental review laws."[85] This should clearly include requirements for restoration of all of the sea-run species that are so

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[82] Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7. This document is attached to these Comments.

[83] *American Rivers*, 895 F.3d at 51 (citing *Delaware Riverkeeper Network v. FERC*, 753 F.3d 1304, 1310 (D.C. Cir. 2014).

[84] 16 U.S.C. 797(f).

[85] 40 C.F.R. § 1502.24(a). And of course the ESA contains the policy overlay requiring that the Commission "shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." 16 U.S.C. § 1531(c)(1).

important to Maine's environment and economy. But the Draft EA is devoid of any such analysis, as set forth below.

i. Failure to analyze the environmental consequences of not passing the full suite of sea-run species.

Another glaring omission in the Draft EA is the complete lack of any evaluation of passage standards for species other than salmon, leading to – in what can be only characterized under the *American Rivers* standard as a "breezy dismissal"[86] – its recommendation that there be no passage standards for the full suite of sea-run species. The Draft EA thus ignores Maine's multi-species restoration goals for the Kennebec, as set forth by the MDMR for Atlantic Salmon, American shad, alewives, blueback herring and American eels/sea lampreys:

> Minimum Species Goals for the Kennebec River
>
> The minimum goal for **Atlantic Salmon** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 500 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for Endangered Species Act (ESA) down-listing and a minimum annual return of 2,000 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for reclassification based on the NOAA and USFWS Recovery Plan (2019). To reach spawning/rearing habitat in the Sandy River, Carrabassett River, and mainstem Kennebec River, all returning adults must annually pass upstream at the Lockwood, Hydro Kennebec, Shawmut, and Weston project dams.
>
> The minimum goal for **American Shad** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 1,018,000[1] wild adults to the mouth of the Kennebec River; a minimum annual return of 509,000 adults above Augusta; a minimum of 303,500 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 260,500 adults annually passing upstream at the Shawmut Project

[86] *American Rivers*, 895 F.3d at 50.

dam; and a minimum of 156,600 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Blueback Herring** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 6,000,000 wild adults to the mouth of the Kennebec River; a minimum annual return of 3,000,000 adults above Augusta; a minimum of 1,788,000 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 1,535,000 adults annually passing upstream at the Shawmut Project dam; and a minimum of 922,400 adults passing upstream at the Weston Project dam.

The minimum goal for **Alewife** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 5,785,000 adults above Augusta; a minimum of 608,200 adults annually passing at the Lockwood, Hydro Kennebec, and Shawmut project dams; and a minimum of 473,500 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Sea Lamprey and American Eel** is to provide safe, timely, and effective upstream and downstream passage throughout the historically accessible habitat of these two species.[87]

The Draft EA's recommendation to ignore passage standards for species other than Atlantic salmon is not just clearly inconsistent with Maine's management goals but also undercuts them. Moreover, MDMR explicitly states that the proposed fish passage measures at Shawmut would be unlikely to meet these minimum goals for any of the species.[88] These goals are important to the ecology of the Gulf of Maine and Maine's

[87] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322). Hydroelectric Project, State Water Quality Certification. July 17. p. 2. Accessible at https://www.maine.gov/dep/ftp/HYDRO/WaterQualityCertifications/Shawmut/agency-comments/DMR%20Comments%20to%20DEP%20WQC%20Shawmut_July.pdf. Also attached to these Comments.

[88] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322). Hydroelectric Project, State Water Quality Certification. July 17. p.2. https://www.maine.gov/dep/ftp/HYDRO/WaterQualityCertifications/Shawmut/agency-comments/DMR%20Comments%20to%20DEP%20WQC%20Shawmut_July.pdf

iconic and economically critical marine industries. NMFS shares the MDMR's goals, stating in its comments on the Shawmut license application that:

> [t]he Kennebec River watershed once produced large runs of Atlantic salmon, American shad, blueback herring and alewife, as well as other sea-run fish including shortnose and Atlantic sturgeon (MSPO, 1993). Diadromous fish once contributed to substantial commercial, recreational, and subsistence harvests (MSPO, 1993) that were economically important to coastal communities. Anadromous fish production within the Kennebec River experienced dramatic declines throughout the past 150 years. Multiple plans since the 1980s, including the Kennebec River Resource Management Plan (1993), KHDG Settlement Accord (1998) and Atlantic salmon recovery plan (2019), highlight the importance of fish passage and habitat restoration as critical to supporting a restored anadromous fishery. Significant spawning, rearing, and migratory habitat exists above the Shawmut Project. Existing dams prevent access to those historical habitats.[89]

The Draft EA's failure to consider the positions and recommendations of the state and federal natural resource agencies is a far cry from an objective hard look at the impacts of the relicensing of the project.

ii. The Draft EA errs in concluding that other species need not be passed.

The Draft EA creates a false choice by suggesting it cannot require Brookfield to restore both salmon and the sea-run species with which they coevolved. First, there is no evidence that improvements in fish passage for other species would harm salmon, as the Draft EA so boldly declares.[90]

In the June 19, 2009 NMFS and USFWS determination of endangered status for the GOM DPS of Atlantic salmon, the agencies found:

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[89] 2020. NMFS. Comments, Recommendations, Preliminary terms and Conditions, and Preliminary Fishway Prescriptions for the Shawmut Hydroelectric Project (FERC No. 2322). Pp. 43-44. August 28. FERC Accession Number 20200828-5176.

[90] Draft EA at p.120.

> Of particular concern for Atlantic salmon recovery efforts within the range of the GOM DPS is the dramatic decline observed in the diadromous fish community. At historic abundance levels, Fay et al. (2006) and Saunders et al. (2006) hypothesized that several of the co-evolved diadromous fishes may have provided substantial benefits to Atlantic salmon through at least four mechanisms: serving as an alternative prey source for salmon predators; serving as prey for salmon directly; depositing marine-derived nutrients in freshwater; and increasing substrate diversity of rivers.[91]

As an additional example undermining the unsupported Draft EA conclusion, running the upstream fish lift 24 hours a day to allow nocturnal sea lamprey migration would not interfere with Atlantic salmon upstream migration. Sea lamprey (discussed further below, in subsection v) are also particularly important for salmon recovery because Atlantic salmon show a preference for laying their eggs in old sea lamprey redds.[92] Additionally, restoration of the suite of sea-run species with which Atlantic salmon co-evolved is necessary to restore Atlantic salmon. These species provide a prey buffer for salmon, particularly for salmon smolts migrating downstream at the same time that alewife and blueback herring are at the peak of their upstream migration. Without this buffer, avian and fish predators will focus their attention on salmon smolts. With large numbers of alewife and blueback herring migrating upstream during the smolt migration, predation on less numerous and smaller salmon smolts will be much reduced. Hence, without this prey buffer, salmon restoration is likely impossible.[93]

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[91] 74 Fed. Reg. 29,344-01 at 29,374-75 (Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon) (June 19, 2009).

[92] Saunders, R., *et a*l. 2006. Maine's Diadromous Fish Community: Past, Present, and Implications for Atlantic Salmon Recovery. Fisheries 31: 537-547. Accessible at http://www.gulfofmaine.org/kb/uploads/1717/saunders%20et%20al.pdf.; *see also* 74 Fed. Reg. 29,344-01 at 29,375 ("Sea lampreys likely provide an additional benefit to Atlantic salmon spawning activity in sympatric reaches.") (citing, *inter alia*, Kircheis, 2004).

[93] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*). Hadley, Massachusetts. January 2019. 74 pp. at P11 (hereafter "2019 Final Recovery Plan"). *See also* 74 Fed. Reg. 29,344-01 at 29,374-75

The Final Recovery Plan for the Gulf of Maine DPS of Atlantic salmon makes clear both that dams were a primary factor in in the decimation and near extirpation of Atlantic salmon runs and that the continued low abundance of co-evolved diadromous fish is a "secondary stressor" that contributes to reduced survival of Atlantic salmon:

> Damming rivers, thus preventing migration to spawning grounds, was a major factor in the decline of Atlantic salmon and much of the co-evolved suite of diadromous fish (e.g., alewife and blueback herring). Many co-evolved diadromous species have experienced dramatic declines throughout their ranges and current abundance indices are fractions of historical levels. The dramatic decline in diadromous species has negative impacts on Atlantic salmon populations, including through depletion of an alternative food source for predators of salmon, reductions in food available for juvenile and adult salmon, nutrient cycling, and habitat conditioning. These impacts may be contributing to decreased survival in lower river and estuarine areas.[94]

And analytically, the "exacting" requirement under NEPA is to consider the environmental consequences of the action on the whole environment, the entire ecosystem – not just one component of it. If the Shawmut Dam will block passage of other sea-run species, to any degree, that alone is a significant environmental consequence that the Commission must "grapple with."[95] When it is considered further that that environmental consequence of blocking passage of other sea-run species likely heralds the death knell to efforts for the recovery of an endangered species, to not even consider the issue in the Draft EA clearly fails to comport with the requirements of NEPA.

(NMFS Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon) (June 19, 2009).

[94] 2019 Final Recovery Plan at p. 11.

[95] *American Rivers*, 895 F.3d at 51.

iii. The Draft EA fails to provide adequate information to assess use of the USFWS Turbine Blade Strike Analysis model.

One particular failure in conducting an Environmental Assessment instead of an Environmental Impact Statement under NEPA, is that conclusions such as use of the USFWS Turbine Blade Strike Analysis model[96] are left without the means of validation. Moreover, the information was not provided to the public by Commission staff when requested. Commission staff must provide all necessary information (all inputs for the blade strike model) for the NGOs and the public to validate conclusions based on this model. Part of taking a "hard look" under NEPA is providing the public with the information necessary to engage in that hard look. This aspect of the Draft EA analysis is deficient in this respect.

iv. The Draft EA's statement that shad may be unmotivated to pass upstream makes no sense.[97]

Shad migratory motivation can be assessed by the distance fish move upriver and by their behavior at artificial barriers, and specifically for the number of times fish attempt to enter a fish ladder and the time spent attempting to pass a dam. Repeated entries in the face of failure and extended residence in proximity to a dam represent a strong upstream drive. Telemetry studies of upstream shad movement at fishways often assess the number of entries into a ladder or fish lift and the time spent attempting to ascend a fishway. An unmotivated fish that failed to pass the fishway would be expected to fall back and not attempt entry again within a short period of time.

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[96] Draft EA at p. 53.

[97] Draft EA at p.44.

In a review of American shad for the Atlantic States Marine Fisheries Commission, historic shad runs are reported as long as 451 miles (726 km) in the Great Pee Dee and Yankin Rivers in North Carolina and over 500 miles (805 km) in the Susquehanna River (Green et al., 2009). These fish bypass significant reaches of suitable spawning habitat. Fish that migrate upstream in the Connecticut River pass multiple suitable spawning habitats areas of the river while migrating to Turners Falls (Layzer 1974; Kleinschmidt, 2016). The extent of historic shad migration in the Kennebec and Sandy Rivers is well documented in Maine's 1993 Kennebec River Resource Management Plan:

> Shad historically ascended the Kennebec River as far as Norridgewock Falls (89 miles from the sea), the Sandy River a few miles from its mouth, and the Sebasticook River in small numbers to Newport. Atkins indicated that shad ascended the Sandy River as far as Farmington.[98]

Radio telemetry studies of American shad on the Connecticut (Kleinschmidt 2016a & Kleinschmidt, 2019) and Susquehanna Rivers (Normandeau, 2011 & Normandeau, 2012) show a strong motivation for upstream passage when encountering a dam. For both rivers, Table D (below) lists the number of American shad, the number of entries, and the maximum number of entries made by a single fish. In 2018 the area around the Cabot Station tailrace and ladder entrance was ensonified with an ultrasound array in an effort to prevent shad from entering the ladder (FERC No. 1889). Even with a sound field designed to repel them, shad moved into the area searching for an upstream route of passage – a clear showing of a strong motivation to migrate upstream.

[98] Maine State Planning Office. 1993. Kennebec River Resource Management Plan. Augusta, Maine. February 1993. P. 79.

Table D. River, fishway, year of study, number of shad entering fishway, number of entries, and the maximum number of entries by a fish.

River	Location	Year	Shad	Entries	Maximum # Entries
Connecticut	Cabot ladder	2015	102	408	8
Connecticut	Cabot ladder	2018*	53	117	7
Connecticut	Cabot ladder	2019	51	260	28
Susquehanna	East Fish Lift	2010	65	102	9
Susquehanna	East Fish Lift	2012	29	49	6

* Area around ladder entrance ensonified

In 2015, 54 radio tagged shad spent an average of 10.7 days (range 0.3 to 40.1 days) within 1.2 kilometers of the Cabot Station at the Turners Falls Project without passing. 24% of those fish spent over 15 days at the project (D. Pugh unpublished data). These fish had passed multiple known shad spawning areas in the river before reaching the Turners Falls Project, demonstrating that they were motivated to move upstream but had trouble passing the dam (Layzer, 1974; Kleinschmidt, 2016b).

Similarly, experience with dam removals in Maine indicates that American shad will colonize habitat above a removed dam as soon as the barrier is removed. On the Kennebec River, following removal of Edwards Dam in 1999, anglers caught shad in the tailrace of the Lockwood Dam, 17 river miles upstream, by mid-May of 2000. Twenty years later there is a thriving recreational fishery for shad each spring. Similarly, on the Penobscot River, following removal of the Great Works Dam in 2012 and Veazie Dam in 2013, the fish lift at the Milford Dam, 9 river miles upstream, captured 1,806 shad in 2014.[99] By 2021, shad captures at Milford Dam have increased to 11,572.[100] Given this

[99] Maine DMR Fish Trap data, accessed here: https://www.maine.gov/dmr/science-research/searun/programs/documents/trapcounts2020.pdf.

[100] *Id*. (https://www.maine.gov/dmr/science-research/searun/programs/trapcounts.html)

hard and readily available data, Commission staff's conclusion in the Draft EA that American shad are "unmotivated" to pass upstream is unusual, at best.

v. The Draft EA errs in analysis on issues of sea lamprey passage.

The Draft EA states that the importance of upstream habitat to historical habitat for sea lamprey is not known and that sea lamprey may not be motivated to pass upstream.[101] However, sea lamprey are known to migrate several hundred kilometers upstream from the ocean. Bigelow and Schroeder note migration of 320 kilometers in the Susquehanna River and 240 kilometers in the Savannah River (Beamish, 1980). Tens of thousands of sea lamprey pass the Holyoke dam every year at river kilometer 139, a similar distance as the Weston Project which is at river kilometer 132. Prior to dam construction on the Kennebec, sea lamprey certainly migrated beyond where the lower four mainstem dams are now located. Sea lamprey recolonization of Sedgeunkedunk Stream in 2010 and 2011 above a previously impassable barrier demonstrates that they will utilize previously unavailable habitats. Sedgeunkedunk Stream experienced a fourfold increase in population in the two years after dam removal (Hogg et al., 2013).

Sea lamprey are similarly highly motivated as American shad. For example, on the Connecticut river, they move rapidly from Holyoke to the Turners Falls project (54.5 km, median time of 33.8 hours) for a median migration speed of 0.45 m s^{-1} (Castro-Santos et al., 2017). This included time for the fish to find and enter the Cabot ladder and does not consider any tortuosity of upstream movement, so this migration speed is almost certainly an underestimate. Indeed, in a controlled flume, sea lamprey were able to ascend channels with velocities as high as 3.5 m/s (T. Castro-Santos pers. Comm.).

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[101] Draft EA at pp. 43-44.

During studies in an experimental fishway at the USGS Conte Anadromous Fish Research Center, sea lamprey were highly motivated swimming against the retaining barrier at the lower end of the fishway prior to the start of tests (D. Pugh pers. Comm).

The importance of sea lamprey to Atlantic salmon recovery cannot be overemphasized. Sea lamprey provide important ecological functions including reducing sediment in pool tail and riffle spawning habitat and transport of nutrients to freshwater habitats. Sea lamprey also build large oval redds which restructure the substrate, shifting small rocks, and reducing embeddedness as flows sweep away fines and silt increasing interstitial spaces (Souse et al., 2012). Hogg et al. 2014 describe changes in stream-bed complexity including a reduction in embeddedness and an increase in macroinvertebrate abundance in mounds compared to pits and reference locations. The physical/substrate changes persisted through September. Intragravel permeability declined in the uppermost reach compared to the lowest reach, where sea lamprey had access prior to dam removal, at a statistically significant level. The authors postulate that this may reflect the lack of anadromous spawning for more than 150 years. A decrease in embeddedness between mounds, pits and reference sites between the summer of 2010 and autumn of 2011 suggest that sea lamprey spawning may condition the substrate.

Atlantic salmon – as well as brook trout – use the same habitat as sea lamprey for spawning, at times superimposing their redds over those of sea lamprey (Kircheis, 2004). In addition, by clearing fines and debris, sea lamprey provide favorable habitat for macroinvertebrates and provide a food source for macroinvertebrates after they die (Nislow and Kynard 2009, Weaver et al. 2016, Weaver et al. 2018). Macroinvertebrates are a primary food source for salmon fry and parr (Grader and Letcher, 2006).

Thus, the Draft EA errs when it cites the lack of motivation of sea lamprey and American shad as a reason not to set performance standards for passage for those species. Both species migrate long distances, passing spawning habitat while moving to upriver habitat that is preferred. Movement in open river and at fishways for sea lamprey and shad has been documented at numerous sites and the Draft EA's failure to set performance standards for their passage at Shawmut Dam is inexcusable. The impressive performance of sea lamprey moving upriver after tagging in the Connecticut River, the determination of shad to enter the Cabot ladder, and the rapid recolonization by shad of previously-inaccessible river reaches following removal of the Edwards, Veazie, and Great Works Dams, belies any concerns about their motivation. The Draft EA's reliance upon the unreliable assertions that these species would not be motivated to pass the Shawmut Dam amount to an improper "breezy dismissal" of both the environmental consequences of failure to pass, and the affirmative requirements to pass sea lamprey and shad to avoid adverse impact to the environment, particularly given their importance to a species on the verge of extinction.[102]

D. The Failure to Consider Dam Removal

i. The Draft EA ignores MDMR and NOAA recommendations for dam removal.

As summarized above, under the Federal Power Act "[n]o license may be issued unless the Commission first determines that the proposed project 'will be best adapted to a comprehensive plan for improving or developing' the relevant waterways." *American Rivers and Alabama Rivers Alliance v. Federal Energy Regulatory Commission*, 895 F.3d

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[102] *American Rivers*, 895 F.3d at 50-51.

32, 36 (D.C. Cir. 2018) (quoting 16 U.S.C. § 803(a)(1)). "In making that judgment, the Commission must give '**equal consideration to** the purposes of energy conservation, **the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat)**, the protection of recreational opportunities, and the preservation of other aspects of environmental quality.'" *Id.* (quoting 16 U.S.C. § 797(e)) (bold emphasis added). In furtherance of the standard, compliance with the mandates of NEPA as implemented by the regulations of the Council on Environmental Quality ("CEQ"), 40 C.F.R. parts 1500 through 1508, compels federal agencies "to take a hard and *honest* look at the environmental consequences of their decisions." *American Rivers*, 895 F.3d at 49 (italics emphasis added). In light of this standard, for the Draft EA to simply brush off the state and federal wildlife agencies' recommendations for decommissioning and removal of the Shawmut Dam without "hard and honest" analysis, violates NEPA.

Brookfield's own analysis states that dam removal is the cheapest and most effective mode of fish passage at the Shawmut Dam. Brookfield received a one-year extension on its license in order to carry out a fish passage study at three of its four dams between Waterville and Skowhegan, including the Shawmut Dam.[103] For the Shawmut Dam, this study concluded that dam removal was the cheapest and most effective fish passage option.[104] Despite this, and the recommendations from NMFS and MDMR to remove the dam, Commission staff unacceptably dismissed removal as an option with almost no analysis.

[103] Kleinschmidt. 2018. Brookfield White Pine Hydro, LLC, Energy Enhancements and Lower Kennebec Fish Passage Improvements Study. October. P. 18; FERC Accession No. 20191106-5142.

[104] *Id*.

This lack of hard analysis of the dam removal option fails to meet the Commission's obligation to "ensure the professional integrity, including scientific integrity, of the discussions and analyses and environmental documents" and to "make use of reliable existing data and resources." 40 C.F.R. § 1502.23. This failure is compounded by the Draft EA's failure to consider both the experience of and outcomes associated with several past dam removals in Maine of dams comparable to Shawmut including the Edwards, Fort Halifax, Great Works, and Veazie Dams, for example, as well as the experience and expertise of the state and federal natural resources agencies. These failures are even more reason for a finding that the Draft EA is woefully deficient.

ii. The Draft EA ignores the NMFS/USFWS 2019 Final Recovery Plan and the 2009 ESA listing for Atlantic salmon.

The Draft EA falls short of the Commission's obligations under NEPA to consider "best available scientific data" by ignoring the terms of the 2019 Final Recovery Plan for Atlantic salmon and the 2009 Endangered Species Act listing for Atlantic salmon.[105] Under NEPA, even under the less stringent requirements with respect to the preparation of an environmental assessment, the Commission is required to "integrate" environmental analyses with "related surveys and studies required by all other Federal environmental review laws . . ., including the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), . . . and the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)." 40 C.F.R. §§ 1501.5(g)(3), 1502.24(a). The Commission is also required to

[105] U.S. Fish and Wildlife Service and NMFS. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) ("2019 Final Recovery Plan"); 74 Fed. Reg. 29,344-01 (June 19, 2009) (Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon).

"ensure the professional integrity, including scientific integrity, of the discussions and analyses and environmental documents" and "shall make use of reliable existing data and resources." 40 C.F.R. § 1502.23.

The purpose of the Fish and Wildlife Coordination Act is "to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation . . . ." 16 U.S.C. § 661. Under the Endangered Species Act, the Commission also has a coextensive responsibility "to conserve endangered species and threatened species and shall utilize [the Commission's] authorities in furtherance of the purposes of this chapter [i.e., the ESA]," and to "cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." 16 U.S.C. § 1531(c)(1) & (2); *Tennessee Valley Authority v. Hill*, 437 U.S. 153, 185 (1978) ("In addition, the legislative history undergirding § 7 [of the ESA] reveals an explicit congressional decision to require agencies to afford first priority to the declared national policy of saving endangered species."). "The plain intent of Congress in enacting this statute [the ESA] was to halt and reverse the trend toward species extinction, *whatever the cost*." *Id*. at 184 (italics emphasis added).

Thus, for the Draft EA to ignore the inconsistencies of its results with the recovery actions set forth in the 2019 Final Recovery Plan for endangered Atlantic salmon is unacceptable and shirks the Commission's responsibilities under NEPA. The Draft EA ignores the required "best available science" on Atlantic salmon restoration, and by doing so it yields arbitrary and capricious conclusions regarding the number of fish that must be passed at the lower four Kennebec Dams in order to meet the 2019 Final Recovery Plan for Atlantic salmon.

Doing so is particularly galling in light of the long history of the State of Maine, USFWS, and NMFS working together for the conservation and recovery of Atlantic salmon. In the early 1990s, these state and federal agencies worked together on a pre-listing recovery plan for Atlantic salmon and initiated the river-specific stocking program. The GOM DPS of Atlantic salmon was listed under the Endangered Species Act (ESA) in 2000, and this listing was expanded in 2009 to include a broader geographic range within the State of Maine, and to designate the species' critical habitat under the ESA, *see* 74 Fed. Reg. 29,344-01; 74 Fed. Reg. 29,300, an area that totally encompasses the Shawmut Project.

The Draft EA's reference to the 2019 Final Recovery Plan on page 141 in section 5.4, and Commission staff's unexplained conclusory statement that "[n]o inconsistencies were found" with it, is by definition fundamentally arbitrary and capricious. The 2019 Final Recovery Plan concludes that dams are "one of the most significant threats to Atlantic salmon" and concludes that the most significant top "Recovery Action" is to: "**Remove Dams to Ensure Access to Habitats Necessary for Atlantic Salmon Recovery**."[106]

> One of the most significant threats to Atlantic salmon are dams. Dams block or significantly impede a salmon's ability to access freshwater habitats essential for spawning and juvenile rearing. Dams, especially dams with turbines, can delay, injure or kill a significant number of downstream migrating smolts as they are heading to the ocean. Dams can kill (directly or indirectly) post-spawn adults (kelts) as they attempt to return to the ocean, preventing their ability to spawn

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[106] 2109 Final Recovery Plan at C2.0 at 33 (bold emphasis added).

> again. **Dam removal offers the highest likelihood of addressing these threats.** . . .[107]

And lest the specific point is missed on even the most casual reader, recovery action C2.4 is to, **"[w]hen feasible, remove hydro-electric dams that afford significant conservation benefit to Atlantic salmon and the ecosystems that they depend on."**[108] These Recovery Actions are higher in order of priority than "improving fish passage at dams." Compare C2.0 with C3.0.[109] So, to be clear, for the lower Kennebec dams in the Merrymeeting Bay Salmon Habitat Recovery Unit (SHRU),[110] NMFS and USFWS have prioritized *removal* of hydro-electric dams over installation of fishways, in the official final plan for recovery of Atlantic salmon – a priority further reflected in NMFS's recommendation for removal in its comment on the Shawmut final license application.[111] In direct contrast, in this Draft EA, Commission staff prioritize new fishways (ignoring best available science on their inefficacy) over dam removal, ignoring not only the best available science on their inefficacy but also the very clear position and priority of a fellow federal agency.

That is a glaring inconsistency for the Draft EA, and one that NEPA requires the Commission to "grapple with." *See American Rivers v. Federal Energy Regulatory Commission*, 895 F.3d 32, 51 (D.C. Cir. 2018) (in requiring "compounded" analysis of

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[107] *Id*. (bold emphasis added).

[108] 2019 Final Recovery Plan, C2.4 at p. 34 (bold emphasis added).

[109] 2019 Final Recovery Plan at pp. 33-34.

[110] 2019 Final Recovery Plan at ix.

[111] FERC Accession No. 20200828-5176 (NMFS Comments, Recommendations, etc. for the Shawmut Project) at pp. 43-44.

mortality factors, noting that "fish that manage to run the gauntlet of youth and natural mortality factors will now emerge only to face a high rate of death in hydropower turbines and other lethal aspects of the Project. The Commission's NEPA analysis has to grapple with that."). Brookfield's own feasibility study of record admits that removal of the Shawmut dam is not only feasible but also the most economic and efficient feasible solution, more so than installation of fish passage facilities.[112] Federal and state wildlife agencies have unequivocally conveyed a consensus position to the Commission staff that by removal there will be a significant, and uniquely pivotal, conservation benefit to the recovery of Atlantic salmon, reflected most significantly by the NMFS and MDMR recommendations for decommissioning and removal of the Shawmut Project. In reviewing the Draft EA, the Commission therefore must weigh the circumstances that fit the Final Recovery Plan's top Recovery Action, i.e., **"*[w]hen feasible*, [we must] remove hydro-electric dams that afford significant conservation benefit to Atlantic salmon and the ecosystems that they depend on."[113]**

In the Draft EA for the Shawmut Dam, Commission staff focused exclusively on an average of the number of fish captured at the Lockwood fish lift to determine their estimated efficiency of fish passage required for the term of a new license at the Shawmut dam. In doing this Commission staff ignored the ongoing work and progress that has been made protecting and restoring access, and created hatchery capacity for Atlantic salmon restoration in the Kennebec River. These ongoing efforts include:

[112] Kleinschmidt. 2018. Brookfield White Pine Hydro, LLC, Energy Enhancements and Lower Kennebec Fish Passage Improvements Study. October. P. 18; FERC Accession No. 20191106-5142.

[113] 2019 Final Recovery Plan at C2.4 at 34 (bold emphasis added).

- Removal of the only main stem dam in Sandy River, the 313' long Madison Electric Works dam in the summer of 2006. This dam was removed to provide access to spawning habitat for Atlantic salmon and other sea-run fish.

- The replacement of two road-stream crossings and the pending removal of the Walton Mills Dam on Temple Stream in Farmington with approximately $3,000,000 of federal, state, and private funding. Once fully completed in 2022, these projects will fully restore access to more than 2,200 units of spawning and rearing habitat for Atlantic salmon.

- The protection of 5,774 acres of forest land with $1,300,000 of federal Forest Legacy funding plus $300,000 from the State of Maine Land for Maine's Future program. This parcel in Madrid and Phillips, Maine, contains some of the Kennebec River's primary spawning and rearing habitat for Atlantic salmon. Because this parcel is at high elevation, it will provide significant cold water protection for spawning Atlantic salmon, especially important as our waterbodies continue to warm because of the climate crisis.

- Significant funding and effort that has been committed by USFWS to enable hatchery production and stocking of over 100,000 Atlantic salmon smolts into the Kennebec River in 2020 and 2021.

Perhaps most significant is the Draft EA's failure to consider the Final Recovery Plan for Atlantic salmon ("2019 Final Recovery Plan").[114]

The 2019 Final Recovery Plan was adopted to identify and guide species recovery needs under section 4(f) of the Endangered Species Act which directs the development and implementation of recovery plans for all listed species.[115] This 2019 Final Recovery Plan addresses the recovery requirements under the ESA for the GOM DPS of Atlantic salmon. It presents a recovery strategy based on the biological and ecological needs of the species as well as current threats and conservation accomplishments that affect its long-term viability.

The 2019 Final Recovery Plan includes:

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[114] U.S. Fish and Wildlife Service and NMFS. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) 74 pp.

[115] 16 U.S.C. § 1533(f).

- A description of site-specific management actions necessary to conserve the species;
- Objective, measurable criteria that, when met, will allow the species to be removed from the endangered and threatened species list;
- Estimates of the time and funding required to achieve the plan's goals. The plan adopts a planning approach recently endorsed by the USFWS;
- Site-specific recovery actions;
- Objective, measurable criteria for delisting; and,
- Time and cost estimates to achieve recovery and intermediate steps.

The 2019 Final Recovery Plan also provides relevant background information for understanding the proposed recovery program, including a summary of the governance structure, threats, conservation measures, and recovery strategy for the GOM DPS. The simultaneously adopted critical habitat rule[116] delineates recovery units for the expanded DPS. These units, designated as Salmon Habitat Recovery Units (SHRUs), respond to the life history needs and the environmental variations associated with freshwater habitats. The SHRUs encompass the full range of the DPS, by dividing it into three segments:

- The Merrymeeting Bay SHRU, which covers the Androscoggin and Kennebec, and extends east to include the Sheepscot, Pemaquid, Medomak, and St. George watersheds;
- The Penobscot Bay SHRU, which covers the entire Penobscot basin and extends west to and includes the Ducktrap watershed; and,
- The Downeast SHRU, including all coastal watersheds from the Union River east to the "Dennys River."

[116] 74 Fed. Reg. 29,300 (June 19, 2009).

The 2019 Final Recovery Plan goes on to say "The 2009 listing rule called particular attention to three **major threats to Atlantic salmon: dams, inadequacy of regulatory mechanisms related to dams** and low marine survival."[117] The Delisting Objectives include:

- Maintaining self-sustaining, wild populations with access to sufficient suitable habitat in each SHRU;
- Ensure that necessary management options for marine survival are in place; and,
- Reducing or eliminating all threats that, either individually or in combination, pose a risk of endangerment to the DPS…[118]

The 2019 Final Recovery Plan also creates Biological Criteria for Delisting. The Plan states that GOM DPS will be considered recovered when all of the following criteria are met:

- **Abundance**: When the DPS has a self-sustaining annual escapement of at least **<u>2,000 wild origin adults in each SHRU</u>** [emphasis added], for a DPS-wide total of at least 6,000 wild adults;
- **Productivity:** When each SHRU has a positive mean population growth rate of greater than 1.0 in the 10-year (two-generation) period preceding delisting. In addition, at the time of delisting, the DPS demonstrates self-sustaining persistence, whereby the total wild population in each SHRU has less than a 50% probability of falling below 500 adult wild spawners in the next 15 years based on population viability analysis projections; and
- **Habitat:** When sufficient suitable spawning and rearing habitat for the offspring of the 6,000 wild adults is accessible and distributed throughout the designated Atlantic salmon critical habitat, with at least 30,000 accessible and suitable Habitat Units in each SHRU, located according to the known migratory patterns of returning wild adult salmon. This will require both habitat protection and restoration at significant levels.[119]

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[117] 2019 Final Recovery Plan at p. ix (bold emphasis added).

[118] 2019 Final Recovery Plan at p. x.

[119] 2019 Final Recovery Plan at pp. x-xi.

It is vital that the Commission understand that the 43,000+ Atlantic salmon habitat units in the Sandy River watershed (including Orbeton Stream) are pivotal and critical to the recovery of Atlantic salmon in the entire GOM DPS. The recovery of Atlantic salmon in the Kennebec River and its Sandy River tributary, as called for in the 2019 Final Recovery Plan, is critical to the recovery effort of the species as a whole, and must be considered in the Commission's NEPA review. The Draft EA's failure to consider this key significance is fatal to compliance with NEPA.

By ignoring the ongoing restoration of access to spawning and rearing habitat as well as the goals and objectives of the 2019 Final Recovery Plan for Atlantic Salmon in the GOM DPS, Commission staff ignore the required escapement requirement of 2,000 wild adults in the Merrymeeting Bay SHRU. This is only possible if salmon have unfettered access to the more than 43,000 units of habitat in the Sandy River, most of which is in largely undeveloped, well-forested, and higher elevation areas, which makes the habitat highly resilient to climate change.

The Draft EA's fish passage provisions for the lower Kennebec River would limit the number of Atlantic salmon that are able to pass the Shawmut Dam and other lower Kennebec dams, and likely lead to the extinction of the Atlantic salmon population in the Gulf of Maine. The Draft EA's analysis is neither "fully informed" nor "well-considered" and as such fails to take a "hard look" at the "significant" and "intense" environmental impact of relicensing the Shawmut Project. What is required is a full evaluation under NEPA by means of an environmental impact statement *before* any action is taken.[120]

iii. The Draft EA's analysis of dam removal is inadequate and lacks detail.

The Draft EA makes the following demonstrably incorrect assertions in connection with its stunted analysis of dam removal as a viable option to relicensing:

a. Sediment Release. "Removing the dam would release stored sentiment to the Kennebec River." Draft EA pp. 188-89. But at the same time, the Draft EA states that "[t]here is no information on sediment accumulation or containment levels in the project's impoundment." *Id.* Commission staff fail to recognize, however, that experience in Maine has shown that sediment effects are transitory. There have been multiple removals of dams comparable to Shawmut (Edwards, Fort Halifax, Great Works, and Veazie, for example) with no indication of lasting consequences due to sedimentation. FERC's Environmental Assessment that assessed removal of the Great Works and Veazie Dams on the Penobscot River in a lower mainstem river of similar size and character concluded that:

> Under the Proposed Action or Action Alternative 1 (removal of all three dams) there would be minor, short-term, adverse impacts to geologic and soil resources. Dam removal activities would disturb soils and sediments and result in increased turbidity within the projects' areas. However, these impacts would persist only during dam removal activities, and the licensee's implementation of best-management-practices such as silt screens and coffer dams would help to minimize these effects. While some erosion may occur as a result of lower

[120] *American Rivers*, 895 F.3d at 49 (quoting *Sierra Club v. Peterson*, 717 F.2d 1409, 1415 (D.C. Cir. 1983)).

> impoundment levels and increased water velocities, it is expected to be minimal as a result of natural channel substrates armoring the shoreline.[121]

b. Diversity and Wildlife Abundance. The Draft EA's "finding" that the diversity and abundance of wildlife species in the area would not be expected to significantly change if the dam was removed,[122] is simply not true. The diversity of sea-run species would increase, as would the diversity of benthic macroinvertebrates, based on experiences at other dams. This was the case on the Kennebec and Sebasticook Rivers where Yoder et al calculated both Diadromous and Riverine Indices of Biological Integrity (R-IBI, D-IBI) before and after dam removal at Edwards and Fort Halifax Dams. After Edwards Dam removal on the Kennebec River, "the DIBI showed an improvement almost immediately with the 2002 DIBI in the Lockwood to Augusta segment clearly higher than the upstream impoundments."[123] After the Fort Halifax Dam removal on the Sebasticook River both riverine and diadromous IBIs improved immediately, and "[t]he D-IBI showed a comparatively larger increase due to improved access by diadromous species and river herring."[124] In the Penobscot River, total mean abundance and generic richness of benthic macroinvertebrates increased after dam

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[121] FERC Accession No. 20100518-3016. FERC, May 2010. Final Environmental Assessment, Application for Surrender of License, Veazie, Great Works, and Howland Projects, FERC Project Nos. 2403-056, 2312-019 and 2721-020. Section 4.4.1, page 172.

[122] Draft EA at p. 190.

[123] Yoder. C.O., R.F. Thoma, L.E. Hersha, E.T. Rankin, B.H. Kulik, and B.R. Apell. 2008. Maine Rivers Fish Assemblage Assessment: Development of an Index of Biotic Integrity for Non-wadeable Rivers. (Addendum March 31, 2016). MBI Technical Report MBI/2008-11-2. Submitted to U.S. EPA, Region I, Boston, MA. 55 pp. + appendices.

[124] Ibid.

removal at both the Veazie and Great Works sites.[125] Similarly, a fish assemblage study after removal at these sites found that dam removal improves diversity and abundance:

> Dams and their impoundments disrupt river habitat connectivity to the detriment of migratory fishes. Removal of dams improves riverine connectivity and lotic habitat, which benefits not only these fishes but also resident fluvial specialist species. Restoration efforts on the Penobscot River, Maine, are among the largest recently completed in the United States and include the removal of the two lowermost dams and improvements to fish passage at several remaining barriers. We assessed fish assemblages in the main-stem river and several major tributaries before (2010–2012) and after (2014–2016) dam removal using boat electrofishing surveys and a stratified random sampling design. In total, we sampled 303 km of shoreline and captured 107,335 individual fish representing 39 species. Similarity indices and rarefaction curves indicated that significant changes in fish assemblage composition occurred in reaches that underwent both habitat and connectivity changes (i.e., directly above removed dams). The newly connected reaches became more similar in fish assemblage composition, as demonstrated by an average increase of 31% in similarity scores. The changes in similarity score in these reaches were driven by increasing access for anadromous fishes and decreasing abundances of slow-water specialist species. For example, we observed a marked reduction in lacustrine species in former impoundments. These assemblage shifts were further illustrated by nonmetric multidimensional scaling in which sites directly above former dams exhibited the largest ordinal shifts immediately following dam removal. We also found all anadromous species in greatest abundance below the lowermost dam during each respective sampling period, though we did find some anadromous species above the lowermost dam during postremoval sampling. Our results demonstrate the potential for large dam removal projects to restore both fluvial and anadromous fish assemblages.[126]

c. Industrial Infrastructure. The Draft EA concludes that removal of the dam would cause problems with industrial and municipal in-river infrastructure.[127] This is

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[125] Kusnierz, D., et al. 2021. A Comparative Analysis of Benthic Macroinvertebrate Communities and Water Quality Before and After Removal of the Great Works and Veazie Dams, Penobscot River Restoration Project. A report to The Nature Conservancy pursuant to Contract ID: PRRP Water Quality Analysis_2017_PIN_DKusnierz. National Oceanic and Atmospheric Administration Rebuilding Sea-Run Fisheries: A103519. P. 18.

[126] Watson, J.M., et. al. 2018. Dam Removal and Fish Passage Improvement Influence Fish Assemblages in the Penobscot River, Maine. *Transactions of the American Fisheries Society.* Accessed at https://usgs-cru-individual-data.s3.amazonaws.com/jzydlewski/intellcont/2018%20Watson%20et%20al%20Dam%20removal%20and%20fish%20assemblages-1.pdf.

[127] Draft EA at p. 191.

also not true based on past Maine experience. In cases of dam removals on the Penobscot and the Kennebec, municipalities and industries were able to relocate in-river infrastructure. Further, the State of Maine is well aware of these needs and still supports dam removal. As with other dam removals in Maine, industrial in-river infrastructure can be relocated or reconfigured, and there would almost certainly be financial assistance provided to do so. This was the case with the Penobscot River Restoration Project, where appropriate measures to protect infrastructure were proposed by the applicant and this Commission's Final Environmental Assessment concluded that: "With proper mitigation as proposed by the Trust and Commission staff, however, the infrastructure would be adequately protected and no impact would occur upon this environment from these actions."[128]

In addition, a free-flowing river would increase the assimilative capacity of the Shawmut reach and make it easier for dischargers such as Sappi to attain water quality standards. Currently, the Shawmut impoundment is not in attainment with Maine water quality standards due, in part, to potential failure to meet aquatic life standards for benthic macroinvertebrates.[129]

In the final analysis, the Draft EA provides no quantitative analysis of fish passage over remaining dams in the absence of the Shawmut Dam. It also does not examine the water quality benefits of dam removal or accurately portray current water quality problems in the Shawmut impoundment. This does not allow valid conclusions

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[128] FERC Accession No. 20100518-3016. FERC, May 2010. Final Environmental Assessment, Application for Surrender of License, Veazie, Great Works, and Howland Projects, FERC Project Nos. 2403-056, 2312-019 and 2721-020. Section 4.4.11, p. 178.

[129] Maine DEP. 2018. 2016 Integrated Water Quality Monitoring Report. P. 60. Accessed at https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

about the adequacy of engineered fish passage as a mitigation measure. The bottom line is that the failure to analyze dam removal in the context of the compounded effects of hydropower projects and dams both up- and downstream from Shawmut, in turn fails to meet NEPA's requirement that the lead agency evaluate the environmental consequences of this major federal action "to the fullest extent possible" in a "well-considered "and "fully informed" analysis.[130]

iv. The Draft EA fails to analyze run-of-river issues "to the fullest extent possible."[131]

The Kennebec Coalition's August 29, 2020 comments on the license application raised concerns about the magnitude, frequency, and duration of fluctuations in Kennebec River flows below the Shawmut Project.[132] The primary concern was on impacts of flow changes on fish passage and instream habitat—particularly if short duration flow fluctuations occur during critical periods for migration and spawning. USFWS raised similar concerns in its August 27, 2020 "Comments, Recommendations, Preliminary Terms and Conditions, and Preliminary Prescriptions," and recommended instantaneous run-of-river operation.[133] USFWS further noted that "[s]ince precise inflow is currently unavailable at the Project the headpond should be maintained at the 112 foot elevation and at most vary by 0.5 feet not one foot."[134]

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[130] *American Rivers*, 895 F.3d at 49, 51.

[131] *American Rivers*, 895 F.3d at 51(citing *Delaware Riverkeeper Network v. FERC*, 753 F.3d 1304, 1310 (D.C. Cir. 2014)).

[132] FERC Accession No. 20200831-5332 at pp. 27-34.

[133] FERC Accession No. 20200827-5121 at p. 7.

[134] FERC Accession No. 20200827-5121 at p. 7.

The Draft EA rejects this recommendation. In their analysis, Commission staff seem to have missed that USFWS was suggesting the project approximate instantaneous run-of-river by limiting headpond fluctuations to +/- 0.5 feet. Commission staff instead interpreted the request as requiring absolute run-of-river operation, and erroneously concluded that the USFWS's recommendation would "essentially eliminate any of the minor fluctuations that currently occur when adjustments are made to project facilities."[135] Finally, without any analysis, the Draft EA suggests that "there is no indication that the project is technologically capable of operating under conditions where outflow from the project instantaneously equals inflow, rather than approximates it."[136] But the Draft EA itself notes that data submitted by Brookfield indicate that the project currently operates within a deviation +/- 0.5' of elevation 96% of the time.[137] This strongly suggests that compliance with such a condition is feasible and could be accomplished with existing infrastructure at little or no additional cost.

v. The Draft EA fails to take an "honest and hard look" at the poor economics of the Shawmut Project.

The poor economics of the Shawmut Project and its minimal energy contributions do not justify its relicensing or the damage it does to Maine's environment. As MDMR stated in its comments on the Shawmut relicensing:

> The Shawmut project represents less than 0.1% of the production of electricity in the State of Maine yet, if relicensed with underperforming fishways, would hasten the extinction of an iconic Maine species, Atlantic salmon, and could result in

[135] Draft EA at p. 79.

[136] Draft EA at p. 35.

[137] Draft EA at p. 35 n.29.

> millions of sea-run fish not reaching historic habitats over the term of the license.[138]

As Commission staff also state in the Draft EA, the Shawmut Project is uneconomic with the mandatory conditions from NMFS and USFWS, and it would be significantly more uneconomic if MDMR's recommendations are included. By proposing the relicensing of this project, Brookfield is essentially asking Maine ratepayers to subsidize one of the most destructive dams in the State to the tune of at least $1,424,770 annually.[139] This is senseless.

Moreover, Maine's growing portfolio of non-hydro renewable resources makes the energy generation from Shawmut even less relevant. For example, Maine's solar generation capacity is expected to grow by an additional 1,597 MW over the next 5 years.[140] Even assuming that the capacity factor of the Kennebec dams is 67%[141] and only 15%[142] for solar, expected new solar generation capacity dwarfs the capacity of the Shawmut Dam by about 50 to 1. Shawmut is simply not a necessary part of Maine's energy portfolio.

A recent paper examined the solar acreage necessary to replace hydroelectricity from the Shawmut Dam and other lower mainstem Kennebec dams. It concluded that

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[138] MDMR. 2020. MDMR Response to the Ready for Environmental Analysis (REA) Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions for the Shawmut Project (P-2322-069). P.2. FERC Accession No. 20200828-5199.

[139] Draft EA at p. 103.

[140] Solar Energy Industries Association. Accessed at https://www.seia.org/state-solar-policy/maine-solar.

[141] 2020. Kleinschmidt Associates. Brookfield White Pine Hydro LLC. Application for New License for Major Water Power Project – Existing Dam. Shawmut Hydroelectric Project (FERC No. 2322). January 30. P. B-2. Accessible at https://1drv.ms/u/s!AkLlihAdyxqVklBuZIG6A5l9pnd8?e=sWgbBm.

[142] Energy Information Administration. Accessed at https://www.eia.gov/todayinenergy/detail.php?id=39832.

only 44.4 hectares (110 acres) of solar panels would replace Shawmut generation.[143] In comparison, the size of the Shawmut impoundment, where water quality is potentially not attaining standards and non-native warmwater species dominate, is 530 hectares (1309 acres).[144] Simply put, the Shawmut dam is an antiquated energy project that is too expensive to run, severely damaging to the environment, and unnecessary given the rapid advances in modern renewable energy systems in Maine.

II. Conclusion

In the final analysis, at the culmination of more than two decades of grappling with sea-run fish passage failures and inadequacies with the lower Kennebec hydropower dams, the best available information and scientific data have yielded a number of unassailable points of consensus: 1) no hydropower dam – anywhere on the planet – has consistently maintained 48-hour 95% upstream salmonid passage performance; 2) multi-dam fish passage facilities will not work to restore self-sustaining sea-run populations of Atlantic salmon *and* the other coevolved species – again, it has never been achieved anywhere on the planet, and the scientific data support too great an array of causal impediments – from issues of delayed mortality, to depleted energy reserves leading to unsuccessful spawning, to insufficient per-species seasonal passage percentages both up- and downstream. No current reliable information justifies multi-dam passage systems as

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[143] Sharma, S. and Waldman, J. (2021), Potential Solar Replacement of Hydroelectricity to Reopen Rivers: Maine as a Case Example. Fisheries. https://doi.org/10.1002/fsh.10619. P. 3.

[144] The Shawmut impoundment does not meet State water quality standards. The Shawmut impoundment is listed under Category 3, "Rivers and Streams with Insufficient Data or Information to Determine if Designated Uses are Attained (One or More Uses may be Impaired)," in Maine's 303(d) list. *See* DEP. 2018. 2016 Integrated Water Quality Monitoring Report. P. 59. This is likely due to the lack of both diversity and abundance of macroinvertebrates that require high water quality in the impoundment, a common feature in large impoundments where deeper areas have low flow and dissolved oxygen.

"mitigation" of the environmental consequences posed by these dams, of which Shawmut is included. To be blunt: fish passage facilities will not work, and will not work well enough, to avoid the adverse environmental consequences posed by the dams and their impoundments. And in this case those consequences are especially dire, as the fate of an endangered species hangs in the balance.

And there is nothing in the record that tells us the Shawmut Project is any different. Indeed, the record with respect to this particular licensee, Brookfield, is a history of failure and of delay. Brookfield had the entire period from 2013 to 2019 under the interim species protection plan to try to establish that multi-dam fish passage facilities would work to restore sea-run migrations on the lower Kennebec. Brookfield failed to even get fish the ability to swim freely above the first dam in all of that time. In the face of this failed history, and the further delay and failures resulting from it, Brookfield's assertions that we should all close our eyes to the truth and that the public should continue to accept the situation on the Kennebec is beyond the pale. All current and best scientific data tell us that the situation will not be solved by fish passage facilities installed at Shawmut and at the other three dams. Brookfield's invitation to essentially maintain the status quo and sit back as the iconic Atlantic salmon goes extinct must be rejected by the Commission.

What the Commission should accept is what all the current and best scientific and economic data make clear – the Shawmut Project should not be relicensed. That conclusion is ineluctable if, as required under NEPA, the Commission takes a "hard and honest" look at the wager Brookfield puts to us, the gamble that risks the extinction of an iconic endangered species in the United States. It is time for this Commission to transcend the wishful thinking of its Kennebec Licensees that has prevailed for so many decades, and that has been proven wrong by all current and best available information. The Commission must abandon the idea that engineered fish passage facilities over four dams will address the significant and dire adverse environmental consequences of these four dams on the lower Kennebec, with the Shawmut Project as one of them.

At the very least, this Commission must undertake a hard and *honest* look at the state of this best, current, reliable information, as set forth herein – especially with the State of Maine, its lead wildlife resource agency on this issue (MDMR), and NMFS, all recommending decommissioning and removal of the Shawmut dam. The Commission must grapple with these hard facts, and it must do so in an Environmental Impact Statement. "NEPA requires an Environmental Impact Statement for any major federal action that might 'significantly' affect the human environment."[145] "If *any* 'significant' environmental impacts might result from the proposed agency action then an [Environmental Impact Statement] must be prepared *before* the action is taken."[146] The Federal Power Act mandates giving "'**equal consideration to** the purposes of energy conservation, **the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat)**, the protection of recreational opportunities, and the preservation of other aspects of environmental quality.'" *American* Rivers, *supra*, 895 F.3d 32, 36 (D.C. Cir. 2018) (quoting 16 U.S.C. § 797(e)) (bold emphasis added).

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[145] *American Rivers*, 895 F. 3d at 49 (citing 42 U.S.C. § 4332(C)).

[146] *Id*. (quoting *Sierra Club v. Peterson*, 717 F.2d 1409, 1415 (D.C. Cir. 1983)) (italics emphasis in original).

We urge the Commission to reject the Draft EA, and direct the development of an Environmental Impact Statement that meets the exacting procedural requirements of NEPA, which requires development of a decommissioning plan for consideration, and that truly confronts the irreversible and significant adverse environmental consequences of the Shawmut Project.

Respectfully submitted, this 14th day of August, 2021,

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CERTIFICATE OF SERVICE

I, Russell B. Pierce, Jr., Esq., hereby certify that a copy of these comments was transmitted by electronic means to each of the persons on the Service list maintained by the Secretary of the Commission.

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On 8/7/21, 9:49 AM, "Joseph Zydlewski" <josephz@maine.edu> wrote:

Landis -

Thanks for the kind words. Yes - PLEASE use this information.

We should have a thesis you can point to in short order - but for now you can point to Rubenstein, Sarah and Zydlewski, Joseph, unpublished data.

This will be submitted for publication by the January, so really in pub form ~ June of next year if all goes well.

The major points

1) ATS face poor passage at some dams (e.g. Lockwood)

2) If passing, ATS often face long delays, usually weeks in length - sometimes months

3) Because of the high and rising downstream temperatures in lower rivers in the summer during river entry and migration, there is increased metabolic cost and this is directly related to depletion of limited and fixed energy stores.

4) Our bioenergetic model suggests that these delays significantly lower the probability of spawning success (depletion of energy stores prior to spawning likely leading to mortalities) and biologically significant declines in the probability of repeat spawning (due to energy depletion and likely mortality). For a four dam system, this loss is estimated to be greater than 50% loss for pre-spawn and post-spawn fish. These are likely conservative estimates as delays at dams are associated with increases in searching behavior, and activity means more energy demand.

5) Extensive literature suggests that older, larger, repeat spawning fish are critical for population resilience , and hence recovery (see attached). In the Penobscot River (see Maynard et al., 2018) repeat spawning is less than 1%, far less than occurs in un-dammed ATS rivers. This fact provided direct evidence that dams are associated with and likely causal to low survival (increased mortality) of post spawn salmon and underscored the demographic fragility resulting from this persistent fixed source of mortality.

Joe Z

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Work History:

Self Employed

Current projects:

Maryland Power Plant Research Project – relicensing of Conowingo Project (FERC # 405) on the Susquehanna River and post-license studies at Holtwood (FERC # 1881) and York Haven (FERC # 1888) upstream of Conowingo. Principle areas of responsibility include: up- and downstream fish passage, telemetry data analysis, fish biology, habitat-flow analysis, and American eel passage.

Connecticut River Conservancy – relicensing of First light hydroelectric projects on the Connecticut River at Turners Falls (FERC # 1889) and the Northfield Mountain Pumped Storage Station (FERC #2485). Scoping began in 2012. First Light has filed its final license application. Reviewed study plans, study reports, IFIM review, shortnose sturgeon spawning flow needs analysis, and shad telemetry analysis. Participated in settlement talks with company, state and federal agencies, and NGOs.

SWCA, Inc. – Shortnose and Atlantic sturgeon habitat and protection plans for sewer line crossing construction on the Connecticut River, Springfield, Massachusetts.

Geosyntec consultants - Shortnose and Atlantic sturgeon habitat and protection plans for river bank stabilization on the Merrimack River, Haverhill, Massachusetts

Maine Rivers – relicensing of three projects on the Mousam River (FERC # 14856).

Kennebec Coalition – review and data analysis of downstream smolt radio telemetry studies (2012 – 2015) and the upstream fish passage plan at the Shawmut project on the Kennebec River (FERC # 2322).

Member of the Holyoke Cooperative Consultation Team for the Holyoke Hydroelectric Project (FERC #2004). Post-licensing downstream fish passage planning including configuration of the downstream passage protection structure, review of CFD analysis, analysis of telemetry data of American shad, shortnose sturgeon, and American eel during post licensing studies.

Santo Antônio , January 2010 to June 2011

TIRIS PIT tag installation, data analysis, and fish passage consultation for an experimental fish passage flume on the Rio Maderia, Brazil.

American Rivers, April 2010 to November 2011

Represented American Rivers for the relicensing of three projects on the Susquehanna River – Conowingo Dam, Muddy Run Pumped Storage Project and York Haven Dam. Participated in study plan development, reviewed study reports and prepared comment letters, attended meetings with the project owners, the FERC, state and federal agencies, and NGO's. Developed and independent analysis of American shad telemetry data at York Haven and Conowingo.

University of Massachusetts, Amherst MA January 1997 to January 2009

Research Assistant in the Department of Natural Resource Conservation working at the

Silvio Conte Anadromous Research Center – areas of research included the behavior and movement of adult Atlantic salmon in the Westfield River in Massachusetts using radio telemetry, upstream passage of sturgeons and riverine fishes in a spiral fishway, spawning behavior of shortnose sturgeon in an artificial ‘stream, and downstream passage of sturgeons at a bar rack and louver system with a low level bypass entrance.

Massachusetts Cooperative Fisheries and Wildlife Research Unit, University of Massachusetts, Amherst MA
March 1991 to January 1997

Project Leader for Anadromous Fish Investigations project. Duties include: hire and supervise technicians staffing the Holyoke, Turners Falls, and Westfield River fish passage facilities; conduct recreational angler creel surveys, Atlantic salmon habitat assessment, and juvenile growth and survival estimates; supervise stocking of Atlantic salmon fry for the Connecticut River basin in Massachusetts; coordinate Unit operations with utility companies and state and federal agencies; and prepare budgets and reports.

Education:

Undergraduate

Trinity College
Hartford, CT 1967-71, B.A.
Major: History
Specialty: American History

Continuing Ed.

Greenfield Community College
- Photography I, II & III, Fall 1980-81
- Engineering Drawing, Fall 1978
- Drafting for Engineers, Spring 1979
- Programming Principles and Concepts, Fall 2002
- Advanced Basic for Programmers, Spring 2002
- Database Programming and Procedures, Spring 2005
- Advanced Database Programming, Spring 2006

University of Massachusetts, Amherst
- Principles of Management, Fall 1981
- Microeconomics, Fall 1980
- Macroeconomics, Spring 1981
- Social Conflicts and Natural Resources, Spring 1991
- Biological Limnology, Fall 1991
- Anadromous Fish, Fall 1991
- Biostatistics, Fall 1991
- Intermediate Biostatistics, Spring 1992
- GIS, Spring 1992
- Population Dynamics, Fall 1992
- Animal Movement and Migration, Fall 1992
- Coastal Zone Management, Spring 1993
- Ichthyology, Fall 1993
- Principles of Fisheries Stock Assessment, Spring 1994
- Aquatic Invertebrates, Fall 1994
- Freshwater Fisheries Management, 1997
- Inland Fisheries Management, Spring 1999
- Imaging in Fisheries Science, Fall 2000
- Natural Resource Modeling, Spring 2001

American Fisheries Society Workshops
- Fish Ageing, 1995
- Stream Habitat Assessment, 1996

USFWS - National Education and Training Center
Principles and Techniques of Electrofishing, 1996

DOI-USGS – Motorboat Operator Certification Course, 2000

Certified S.O. Conte Anadromous Research Center dive team member

S.O. Conte Fish Research Projects:

Atlantic salmon behavior and movements in the Westfield River, Massachusetts 1996 to 1998 – wild adult Atlantic salmon returning to the Westfield River were internally radio tagged and released into the upper Westfield River. Fish were tracked with fixed stations and with manual tracking. Movement, habitat choice, spawning, and post-spawning behavior were evaluated. Domestic broodstock Atlantic salmon were also radio tagged and released to assess their spawning potential to contribute to the salmon restoration effort in the Connecticut River basin.

Spiral fishway 2001 to 2007 – evaluation of a spiral, side baffle fishway designed for upstream sturgeon fish passage. Sturgeon, a benthic fish, need a fishway that allows upstream movement while maintaining close proximity to the bottom of the fishway. The spiral uses side baffles to reduce velocity and provide depth allowing fish to move in a sinusoidal curve along the bottom of the channel. Sturgeon movement was evaluated with a PIT tag system detecting fish at the entrance and exit of the fishway and at four points along each of two loops. Riverine fish were also evaluated in the spiral fishway.

Shortnose sturgeon spawning behavior 2002 to 2008 – the spawning behavior of wild Connecticut River shortnose sturgeon was evaluated in an artificial stream. Mating behavior, mate choice, velocity preference, egg to larvae survival, and embryo and larval dispersal timing were evaluated.

Downstream passage and behavior studies of shortnose sturgeon 2004 and 2005 – yearling, juvenile and adult shortnose sturgeon were evaluated for swimming depth, behavior at and movement along a bar rack, entrainment and impingement, and willingness to enter an opening in the bar rack at three different approach velocities. Pressure sensitive (depth) and radio tags were used to assess swimming depth for both upstream and downstream movement in a 20’ by 120’ flume with a velocity of 1 ft/sec. PIT tags and video were used to assess individual fish movement and behavior at a bar rack oriented 90º to flow at velocities of 1, 2 and 3 ft/sec.

Downstream movement of yearling shortnose sturgeon 2004 and 2006 – yearling shortnose sturgeon (Connecticut River stock in 2004 and Savannah River stock in 2006) were evaluated in a large outdoor oval channel with a river stone substrate to determine the timing, frequency and duration of upstream and downstream movements. Fish were tested for 48 hours on a monthly basis from June through November. PIT tags and five antennas were used to determine movement.

Low level orifice use of sturgeon at an angled bar rack and louver 2006 to 2008 – green, lake, Savannah and Connecticut River shortnose sturgeon of different year classes were tested in a 10’ by 120’ flume at two bar rack angles (45º and 30º) and one louver angle (26º) with two velocities at the orifice. Approach velocity (2 ft/sec) and water depth (7.5’) remained constant for all trials. Fish were tested both day and night. Video and PIT tags were used to determine individual fish movement, behavior at the bar rack and passage through the orifice and pipe which transported fish downstream to a holding area.

Past Relicensing Projects:

Bear Swamp Hydroelectric Project – FERC # 2669
Relicensing of project through the ILP.
Deerfield River Project – FERC # 2323, License issued 1997
Deerfield River Compact – precursor to relicensing, all stakeholders in relicensing, including New England Power Co., met on a regular basis to discuss issues. Final report issued.
Deerfield River Settlement – followed the conclusion of the Deerfield River Compact with similar discussions as to the issues involved in relicensing with the goal of reaching agreement on environmental mitigation prior to issuing or license. Represented Trout Unlimited in

meetings with state and federal agencies, New England Power Co. and other NGO's which reached an agreement that was incorporated into and was the basis of relicensing by the FERC.

Holyoke – FERC # 2004, Connecticut River

Relicensing of project – bypass minimum flows, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, clupeids, and riverine fish), upstream passage (adult Atlantic salmon, clupeids, American eels, and riverine fish) freshwater mussel protection, flow priorities (bypass reach, canal, up- and downstream fish passage, hydrogenation, run of river protection of federally threatened tiger beetle), and disabled angler fishing access.

Comments to both company and the FERC concerning above listed issues.

Participant in CCT meetings representing Trout Unlimited concerning above listed issues. CCT consists of Holyoke Gas & Electric (project owners), state and federal agencies, and NGO's (Trout Unlimited and Connecticut River Watershed Council).

Indian River – FERC # 12462, Westfield River

Licensing of project – bypass minimum flows, freshwater mussel protection, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, riverine fish), upstream passage for American eels.

Participation in ongoing fish passage discussions regarding both up- and downstream passage issues.

L.S. Starrett Co. – FERC # UL09-01, Millers River

Installation of new turbine initiated local Conservation Commission and Massachusetts Department of Environmental Protection actions presently on hold due to a FERC order of jurisdiction dated October 21, 2009.

Intervened in Massachusetts Department of Environmental Protection appeal by Starrett of a Superseding Order of Conditions.

Commented to the FERC concerning Starrett Motion for Stay of Order of Jurisdiction regarding downstream fish passage.

Muddy Run Pumped Storage Project – FERC # 2355, Susquehanna River. Contracted by Maryland Power Plant Project to provide biological and fish passage assistance during relicensing and post licensing. Principle issues are entrainment and the impact of the project on river flows.

New Home Dam Project – FERC # 6096, Millers River

Post licensing flow issues - run of river requirement.

Northfield Mountain Pumped Storage Project – FERC # 2485, Connecticut River

License amendment allowing more storage in upper pond. River bank erosion concerns. Amendment application withdrawn.

Woronoco – FERC # 2631, Westfield River

Relicensing of project and 401 certification – bypass minimum flows, freshwater mussel protection, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, riverine fish), upstream passage for American eels, and recreation issues.

Analyzed telemetry data from downstream smolt test to provide independent review of results.

York Haven – FERC # 1888, Susquehanna River

Contracted by Maryland Power Plant Project to provide biological and fish passage assistance during relicensing. Relicensing is currently involved in settlement discussions with project owner, Olympus Power. Principle issues are up- and downstream fish passage for American shad and American eel and bypass flows.

Publications:

Kynard, B., D. Pugh, and T. Parker. 2003. Development of a fish ladder to pass lake sturgeon. Great Lakes Foundation, Final Report, Lansing Michigan.

Kynard, B., M. Horgan, D. Pugh, E. Henyey and T. Parker. 2008. Using juvenile sturgeon as a substitute for adults: a new way to develop fish passage for large fish. American Fisheries Society Symposium 61: 1-21.

Kynard, B., M. Kieffer, E. Parker, D. Pugh and T. Parker. 2012. Lifetime movements by Connecticut River sturgeon. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker, M. Kieffer. 2012. Spawning of shortnose sturgeon in an artificial stream: adult behavior and early life history. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker. 2012. Passage and behavior of Connecticut River shortnose sturgeon in a prototype spiral fish ladder with a note on passage of other fish species. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2012. Downstream and Diel Movements of Cultured Yearling Pallid, Green, Lake, and Shortnose Sturgeons: An Artificial Stream Study. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker. 2004. Experimental Studies to Develop Guidance and a Bypass for Shortnose Sturgeon at Holyoke Dam. Final Report to City of Holyoke, Holyoke Gas & Electric Company, Holyoke, Massachusetts.

Kynard, B., D. Pugh, and T. Parker. 2005. Experimental Studies to Develop Guidance and a Bypass for Shortnose Sturgeon at Holyoke Dam. Final Report to City of Holyoke, Holyoke Gas & Electric Company, Holyoke, Massachusetts.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2007. Use of laboratory studies to develop a dispersal model for Missouri River pallid sturgeon early life intervals. J. Appl. Ichthyol. 23: 365–374.

Kynard, B., D. Pugh, and T. Parker. 2011. Passage and behavior of cultured lake sturgeon in a prototype side-baffle ladder: I. ladder hydraulics and fish ascent. J. Appl. Ichthyol. 47 (Suppl. 1): 1-12.

Pugh, D., B. Kynard. 2001. Westfield River adult salmon report Westfield River, Massachusetts, 1966 – 1968. Final report to United States Forest Service and United States Fish and Wildlife Service.

Pugh, D. 1997. Millers and Chicopee River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 1998. French and Westfield River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 1999. Blackstone, Quinebaug, and Quabog River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D and A. Haro. 2000. Passage of Atlantic salmon at Turners Falls fishways: PIT tag evaluation 1999. Conte Anadromous Fish Research Center Internal Report No 00-02.

Pugh, D. 2000. Merrimack, Ipswich, Charles, and Neponsett/Weymouth/Weir Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 2001. 2001 Fort River dwarf wedge mussel (*Alasmidonta heterodon*) survey. Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program.

Pugh, D. 2002. 2002 Fort River dwarf wedge mussel (*Alasmidonta heterodon*) survey. Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program.

Presentations:

Movement and Habitat of Atlantic Salmon in the Westfield River. D. Pugh. Connecticut River Atlantic Salmon Commission Conference, 1999.

Zebra Mussels: Can We Stop The Eastward Invasion? M. Babione and D. Pugh. Northeast Fish and Wildlife Conference, 2003.

Passage of Sturgeons and Riverine Fishes in a Prototype Spiral Fish Ladder. B. Kynard, D. Pugh, T. Parker. American Fisheries Society Meeting, 2006

Behavior of Lake, Pallid, and Shovelnose Sturgeons at Passage Structures: Toward a New Paradigm in Developing Fish Passage. B. Kynard, M. Horgan, D. Pugh, E. Henyey, and T. Parker. American Fisheries Society Meeting, 2006.

Performance of Lake Sturgeons and Riverine Fishes in a Spiral Side-Baffle Fish Ladder. B. Kynard, D. Pugh, T. Parker. Connecticut River Atlantic Salmon Commission Conference, 2009.

Review of Using a Semi-natural Stream to Produce Young Sturgeons for Conservation Stocking. B. Kynard, D. Pugh, T. Parker, M. Kieffer. International Sturgeon Society Conference, 2009.

Up- and Downstream Passage and Behavior of Lake and other Sturgeons. D. Pugh B. Kynard and T. Parker. Keeyask Fish Passage Workshop, 2011.

Eel Passage Westfield & Millers Rivers, Massachusetts. D. Pugh. ASMFC Eel Passage Workshop, 2011.

Passage and Behavior of Cultured Lake Sturgeon in a Side-Baffled Fish Ladder: II. Fish Ascent and Descent Behavior. NAC. 2011.

Behavior, impingement, and entrainment of shortnose sturgeon at a vertical bar rack: with and without a bypass orifice. B. Kynard and D. Pugh. Fish Passage Conference, Amherst, MA. 2012.

Research on Up-and Downstream Passage of Lake Sturgeons at S. O. Conte Anadromous Fish Research Center. B. Kynard, D. Pugh, E Henyey, T. Parker and M. Horgan. *Scaphirhynchus* Conference: Alabama, Pallid, and Shovelnose Sturgeon Symposium, St. Louis, Missouri, January 2005

Shortnose Sturgeon Life History Requirements and the Holyoke Dam. B. Kynard, M. Kieffer, D. Pugh. Connecticut River Atlantic Salmon Commission Conference, March 2013

STATE OF MAINE
DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

JANET T. MILLS
GOVERNOR

PATRICK C. KELIHER
COMMISSIONER

July 17, 2021

Kathy Davis Howatt
Hydropower Coordinator, Bureau of Land Resources
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333

RE: Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project

Dear Ms. Howatt:

The Maine Department of Marine Resources (MDMR) has reviewed the Brookfield White Pine Hydro, LLC's (BWPH; Licensee) Application for Water Quality Certification (U.S. P.L. 92-500, Section 401) for the relicensing of the Shawmut Project by the Federal Energy Regulatory Commission (FERC). MDMR has also reviewed the Draft Environmental Assessment (DEA), Interim Species Protection Plan (ISPP) for Shawmut, the Final License Application (FLA), Species Protection Plan (SPP) for Lockwood, Hydro-Kennebec, and Weston, as well as other relevant documents in our administrative record. MDMR provides the attached comments and Kennebec River factual background paper focused primarily on the proposal's impacts to diadromous indigenous aquatic fish species and their habitat.

Please contact Gail Wippelhauser at gail.wippelhauser@maine.gov or at 207-904-7962 if you have any questions.

Sincerely,

Patrick C. Keliher, Commissioner

Summary

Restoration of Atlantic Salmon, American Shad, Blueback Herring, Alewife, and Sea Lamprey has lagged on the mainstem Kennebec River, primarily because of the lack of upstream fish passage. This situation is particular critical for the endangered Gulf of Maine (GOM) Distinct Population Segment (DPS) of Atlantic Salmon, one of the most iconic and imperiled species in the United States. Diadromous fish species require safe, timely, and effective access to high quality habitats at different life stages in order to successfully survive and reproduce. The Shawmut Project waters currently are used as spawning and rearing habitat and/or a migratory corridor for five indigenous fish species (Atlantic Salmon, American Shad, Blueback Herring, Alewife, and American Eel). Upstream fish passage has been provided for juvenile American Eel at the lower four mainstem dams, but adult Atlantic Salmon, American Shad, Blueback Herring, and Alewife have been captured at the Lockwood Project fish lift and transported upstream for 15 years (2006-2021). A sixth indigenous species, Sea Lamprey, also will use the Shawmut Project waters as spawning/rearing habitat and as a migration corridor when new upstream passage is implemented at the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects. These aquatic habitats are extremely important for diadromous fish and have been designated as Critical Habitat for Atlantic salmon under the Endangered Species Act (ESA) and Essential Fish Habitat (EFH) under the Magnuson Stevens Act (MSA) for a number of species based on the location and characteristics of habitats required to support healthy fish populations. Almost 100% of high quality Atlantic Salmon spawning and rearing habitat, over 50% of spawning and rearing habitat for American Shad and Blueback Herring, and significant areas for the other native anadromous species in the Kennebec river watershed is upstream of the Shawmut project.

The proposal as described in the Brookfield White Pine Hydro, LLC's (BWPH; Licensee) Application for Water Quality Certification (U.S. P.L. 92-500, Section 401), if implemented, will continue to have significant adverse impacts on these indigenous fish species and their habitat. These adverse impacts include, but are not limited to, anticipated low passage efficiency rates at upstream and downstream fishways, mortality and injury to upstream and downstream migrating diadromous fish, impaired in-stream habitat, significant delays in passage, and cumulative effects of multiple proposed fish passages at other projects in the watershed. Population modeling of the cumulative impacts of upstream and downstream passage of Atlantic Salmon, American Shad, Blueback Herring, and Alewife has shown that efficient downstream and upstream fish passage with minimal delays are critical to support these fish species' life history needs. Unless fish passage facilities meet MDMR's proposed performance standards based on this modeling and also provide effective passage for eels, the project waters will likely be of insufficient quality to support self-sustaining runs of these important indigenous species. Of particular concern, MDMR's analysis strongly indicates that the Licensee's proposal would preclude the ability to recover Endangered Species Act (ESA) listed Atlantic salmon in the entire Distinct Population Segment (DPS). In addition, studies have shown that similar fishways at wide, complex sites such as Shawmut could entirely preclude fish such as American Shad from passing upstream. The Department's goal is to restore diadromous fish populations in Maine to their historic habitat. To achieve this goal, MDMR has developed "minimum goals" that are achievable if suitable habitat of sufficient quality is available to support fish and other aquatic life. In other words, building fish runs to meet these minimum demographic goals is a

benchmark for having resilient self-sustaining populations, which require safe, timely, and effective passage and supportive aquatic habitats. The minimum goals and concerns about how the proposed project will not likely achieve those goals and discussion of additional impacts to fish and aquatic habitat are outlined below. More detail on the modeling and background can be found in the Kennebec River factual background provided as a separate document.

Minimum Species Goals for the Kennebec River

The minimum goal for **Atlantic Salmon** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 500 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for Endangered Species Act (ESA) down-listing and a minimum annual return of 2,000 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for reclassification based on the NOAA and USFWS Recovery Plan (2019). To reach spawning/rearing habitat in the Sandy River, Carrabassett River, and mainstem Kennebec River, all returning adults must annually pass upstream at the Lockwood, Hydro Kennebec, Shawmut, and Weston project dams.

The minimum goal for **American Shad** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 1,018,000[1] wild adults to the mouth of the Kennebec River; a minimum annual return of 509,000 adults above Augusta; a minimum of 303,500 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 260,500 adults annually passing upstream at the Shawmut Project dam; and a minimum of 156,600 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Blueback Herring** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 6,000,000[2] wild adults to the mouth of the Kennebec River; a minimum annual return of 3,000,000 adults above Augusta; a minimum of 1,788,000 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 1,535,000 adults annually passing upstream at the Shawmut Project dam; and a minimum of 922,400 adults passing upstream at the Weston Project dam.

The minimum goal for **Alewife** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 5,785,000[3] adults above Augusta; a minimum of 608,200 adults annually passing at the Lockwood, Hydro Kennebec, and Shawmut project dams; and a minimum of 473,500 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Sea Lamprey and American Eel** is to provide safe, timely, and effective upstream and downstream passage throughout the historically accessible habitat of these two species.

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[1] Based on 5,015 hectares of spawning/rearing habitat and a minimum return of 203 adults per hectare.
[2] Based on 5,015 hectares of spawning/rearing habitat and a minimum return of 1,196 adults/hectare.
[3] Based on 9,946 hectares of spawning/rearing habitat and a minimum of 581.5 adults/hectare; the Maine State average is 988.4/hectare.

Performance standards necessary to meet minimum goals

Upstream fish passage
Based on the minimum goals, a project's facilities would be considered to be performing in a safe, timely, and effective manner if:

1. At least 99% of the adult Atlantic Salmon that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 48 hours.
2. At least 70% of the adult American Shad that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours.
3. At least 90% of the adult Blueback Herring that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours.
4. At least 90% of the adult Alewife that that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours; and
5. At least 80% of the adult Sea Lamprey that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 48 hours.

Downstream fish passage
Based on the minimum goals, a project's facilities would be considered to be performing in a safe, timely, and effective manner if:

1. At least 99% of the Atlantic Salmon smolts and kelts that pass downstream at the next upstream hydropower dam (or approach within 200 m of the project spillway) pass the project within 24 hours.
2. At least 95% of the adult and juvenile American Shad that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.
3. At least 95% of the adult and juvenile Blueback Herring that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.
4. At least 95% of the adult and juvenile Alewife that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.

The Licensees Proposals for fish passage performance

It is unclear what the Licensee is proposing regarding salmon effectiveness standards for the Shawmut project as the proposed Interim Species Protection Plan (ISPP) does not include updated performance standards. In the SPP for the Lockwood, Hydro-Kennebec, and Weston project, the Licensee indicates they will need to achieve a whole station survival of 88.5% for downstream passage and 84.5% for upstream passage at the four projects for Atlantic salmon. This would indicate an average of 97% for downstream passage per project, and 96% for upstream passage. A cumulative performance standard is not supported by MDMR or consistent with the precedent set by the National Marine Fisheries Service (NMFS) and the Federal Energy Regulatory Commission (FERC) for the Milford (FERC No. 2534), West Enfield (FERC No. 2600), Mattaceunk (FERC No. 2520), Orono (FERC No. 2710) and Stillwater (FERC No. 2712) projects on the Penobscot River. Cumulative performance standards can allow one or more projects to perform poorly, increasing the possibility that the cumulative effects will be even greater and reducing project by project accountability. The Licensee does not utilize DMR's recommended performance standards or provide any of their own performance standards for American Shad, Blueback Herring, Alewife, or Sea Lamprey. MDMR has completed model scenarios that represent the best available science and finds that only with a 99% upstream and downstream passage efficiency at each project (Lockwood, Hydro-Kennebec, Shawmut, and Weston) can interim minimum goals be achieved for Atlantic salmon (Factual Background, 3.1.6). Based on MDMR modeling, the 99% upstream and 99% downstream effectiveness scenario resulted in 28-29% more adult salmon returns than the 96% upstream and 97% downstream scenario suggested in the SPP. Further, based the site conditions, initial testing, and experience with similar passage approaches implemented in other river systems, we find it highly unlikely that the Licensee will meet even their own proposed standards. The Licensee had previously indicated it could achieve lower standards yet has revised those standards upward without proposing any significant commensurate measures that would likely result in those improvements. With salmon runs below replacement levels currently, MDMR concludes that the adverse impacts of the current proposal will not provide conditions where a minimum sustainable population of Atlantic salmon can be supported in the receiving water. It is also possible that species such as American Shad, which have chronic poor performance at fishways, or Sea Lamprey, which are not considered by the Licensee and migrate primarily at night, could be entirely precluded from receiving waters based on cumulative impacts from downstream projects and likely ineffective passage at the Shawmut Project. The high numbers of dams in the lower Kennebec, unknown outcomes of fish passage at those projects, and poor demonstrated performance at similar fishways (Factual Background, Table 9) significantly increases the probabilities of failure to meet basic biological requirements for some or all of the indigenous species at the Shawmut project.

Issues with Proposed upstream fish passage facilities

The Licensee has proposed to construct permanent upstream fish passage (a single fish lift) at the Shawmut project. Successful fishways must create hydraulic signals strong enough to attract fish to one or multiple entrances in the presence of competing flows (i.e., false attraction). The Shawmut dam is extremely long and has multiple discharge locations that will provide significant false attraction flows during the passage season. MDMR has serious concerns about the design, operation, and location of the fishway and believes the current proposal will result in significant delays and likely poor upstream passage efficiency for multiple species. MDMR also has serious concerns about the cumulative adverse impacts of the Lockwood, Hydro-Kennebec, and Weston projects, which has similar issues.

MDMR is very concerned about the effectiveness of the proposed fishway in May, June, and July when the majority of anadromous species are migrating upstream (Table 1). The maximum station hydraulic capacity of the Shawmut Project is 6,690 cfs, which is exceeded approximately 65% of the time in May, 35% of the time in June, and 20% of the time in July. Water in excess of station capacity is spilled at the sluice gate in the middle of the 1,435-foot long dam, the hinged flashboards on the west side of the dam, or the rubber crest(s) on the eastern half of the dam, providing multiple false attractions. As a result, there will be false attraction at the project during the majority of the upstream migration season to multiple areas without a fishway to the headpond. A proposed cross channel egress from an identified false attraction zone would not provide passage to the headpond or directly to the lift.

Table 1. Upstream Run timing by month of Atlantic Salmon, river herring (Alewife and Blueback Herring) and American Shad captured at the Lockwood Project (2006-2020) and Sea Lamprey captured at the Milford Project (2009-2020).

Month	Atlantic Salmon	River herring	American Shad	Sea Lamprey
May	9%	72%	2%	56%
June	49%	28%	78%	44%
July	32%		19%	
August	2%			
September	3%			
October	4%			

The location of the fishway was based on very speculative assumptions using limited information. The CFD modeling that was conducted looked at a very limited range of flows that are not representative of the majority of the migration period. Furthermore, the siting study, conducted from May 19-June 14, 2016 with radio-tagged alewife, occurred during a low flow period, which is not representative of flows during the passage season. Alewives are not necessarily a good proxy for fish attraction of other species, as the Lockwood and Brunswick projects demonstrate. The existing American Eel fishway locations were selected based on flow conditions that will be changing based on the proposal.

While it is hard to predict the exact passage efficiency and delays rates at each project, the results of studies conducted on Atlantic Salmon and shad migrating upstream at the Lockwood Project are illustrative. The Lockwood and Shawmut projects are similar in that they are complex, wide sites, that have multiple sources of spill that create false attraction for migrating fish.

> Two years of telemetry studies by Brookfield were conducted at the Lockwood Project. In 2016, 16 of the 18 test fish (88.9%) which returned to the Project area were recaptured in the fish lift, and the time from return to the project area to recapture was 0.7-111.2 days (mean=17 days). In 2017, 14 of the 20 test fish (70%) were recaptured in the fish lift, and the time from return to the project area to recapture was 3.3-123 days (mean=43.5). As part of a study of energy consumption, adult Atlantic salmon were captured at the Lockwood fish lift, tagged with thermal radio tags and released downstream of the Project. In 2018, 66.7% of the tagged adults (4 of 6) were recaptured at the fish lift, and the time to recapture was 16-33 days (mean=21.8). The following year, 45.0% of tagged adults (9 of 20) were

recaptured, and the time to recapture was 9-30 days (mean=18.7). A 2015 study found that 0% of American shad captured in the fishway and returned downstream were recaptured at the fishway.

The Lockwood fishway (fish lift) was designed consistent with current standards for upstream passage of anadromous fish and yet the complicated setup at the dam has undermined the ability of the fishway to effectively pass fish. It would not be unexpected to have similar results at the Shawmut project. Results at projects such as Lockwood show significantly less than minimum goals necessary to support salmon populations and could fully preclude American shad or other species from accessing necessary habitats above the Shawmut project. MDMR believes having only one fishway at this site to the headpond that is non-volitional will likely result in large percentages of fish not finding the fishway and/or experiencing substantial delays.

Operational period

The Licensee proposed to operate the upstream fishway (fish lift) May 1 to October 31 during daylight hours. This proposed upstream operational period is inadequate to effectively pass all species upstream. Atlantic salmon have been documented in the Kennebec River migrating upstream for a longer season and sea lamprey predominately migrate during the night. Fish passage should be provided from May 1 through November 10 with operations occurring 24 hours per day from May 1 through June 30 to accommodate diurnal and nocturnal migrants. In addition, the proposed fish lift is not a volitional facility and its operation is vulnerable to regular mechanical failures and power outages. Fish lifts generally also have a minimum cycle time of about 15 minutes, during which time the fishway is closed. The Licensee considered at a conceptual level both a nature-like fishway (which is volitional) and a fish lift during a feasibility study, but only pursued the fish lift design. MDMR has further explored concepts developed in the Licensees feasibility study and has conceptual designs for a nature like fishway at this site, which can be made available to DEP upon request. There is potential with a nature like volitional and the similarly designed fish lift working together in separate locations, improved upstream fish passage efficiency and timeliness could be achieved.

Issues with Proposed downstream fish passage facilities

The Licensee proposes to utilize three gates in the forebay area (Sluice Gate, Tainter Gate, and Deep Gate) and up to four sections of hinged flashboards to pass fish downstream. The licensee also proposes a guidance boom (discussed below) and no screening protection of fish through the Francis Turbines. Unlike the Licensee proposal in the SPP for the Lockwood, Hydro-Kennebec, and Weston projects, the Licensee does not propose any specific low flow thresholds that would require curtailment of generation to provide for additional spill for protection of downstream passage of Atlantic salmon smolts. The proposal also fails to provide adequate protection for other species during their period of downstream passage. The proposed downstream operational facilities are inadequate to safely and effectively pass Atlantic salmon and all species downstream.

Radio telemetry studies conducted at the Weston, Shawmut, Hydro-Kennebec, and Lockwood projects resulted in baseline survival of downstream migrating Atlantic salmon smolts ranging from 89.5–100%, but only 66-94.5% of smolts successfully passed the projects within 24 hours. The Shawmut project averaged 93% survival. This analysis only measured survival from just above to just below the projects and fails to take into account the impact of the latent mortality and other mortality associated with the cumulative effects of passing multiple projects. For example, smolts that were released at Weston and detected at Lockwood had much lower survival, with a four-year average of 56%, and that does not include the impacts of the Weston impoundment as fish were released just upstream of the dam.

To assess the true impacts of the projects, it is important to account for survival with dam dependency. The NOAA Science Center modeled smolt survival with dam dependency (Stevens et al. 2019) using 40 years of data on the Penobscot River, with estimates of estuarine mortality for fish that passed 4 dams at 1.15% per kilometer versus 0.34% with no downstream dams (natural mortality baseline). MDMR developed a deterministic salmon model utilizing this data and other data in the watershed and modeled smolt survival with four dams under a number of scenarios. Using the passage scenario of 96% upstream and downstream passage per project, these projects would result in a 45% reduction in smolt survival to sea compared to smolt survival without the projects. Using the updated 97% survival per project proposed in the SPP (12% direct mortality across four projects) and NOAAs estimate from a dam impact model (Neiland and Sheehan 2020) of 6% mortality per dam baseline (24% indirect mortality across four projects), would result in 36% mortality of smolts from project effects alone. In NOAAs August 28, 2020 preliminary Section 18 prescription, their analysis estimated about 40% loss of smolts due to project impacts. The loss of between 36-45% of smolts from dam impacts in addition to baseline mortality on a salmon run that is currently below replacement is not supportive of recovery, even under the most favorable marine survival and freshwater production scenarios. It is unlikely that the Licensee could even achieve the 97% downstream standard based on their proposal as many fish would still be entrained in turbines without shutdowns or full screening. Thus, representations of "Whole Station Survival" vastly understate the current take of these projects as they measure only a small window of impacts that do not account for large impacts of impoundments and latent impacts to fish that pass dams (e.g. delayed mortality in estuary rather than directly after passing project). In addition, in their Augusta 28, 2020 preliminary prescription for the Shawmut project, NOAA predicted that the overall survival of kelts through the four projects cumulatively would be 42% to 51%, an incredibly low number of fish that would preclude the important life history trait of repeat spawning.

The proposed guidance structures (discussed below) at the project are unlikely to prevent or reduce entrainment of smaller alosines. In addition, smaller alosines are more likely to migrate past the Lower Kennebec Projects during the summer months (July-September) when water levels are not likely to result in spill at the project. Due to the reduced swimming ability of smaller alosines and the timing of their migrations, MDMR believes that smaller alosines are likely passing through the turbines of the projects at a high rate. Juvenile alosines migrate downstream from freshwater nursery habitat in Maine between July and November each year. While some juveniles stay in nursery habitat and reach lengths of 100-150mm before their downstream migration, a significant portion of the downstream migrants are much smaller (total length 40-100mm) and typically migrate earlier in the year. Smaller alosines do not have the same swimming ability as larger fish and are more likely to utilize routes of passage in a manner proportionate to the ratio of flow to a given a route. For this reason, smaller juvenile alosines are likely to be entrained as they migrate past the project and turbine passage has been documented as the route of highest mortality (acute and latent) when compared to other passage routes. This will result in adverse impacts to these species and not be conducive to meeting demographic or other goals to maintain self sustaining runs above these projects.

Surface Guidance Boom

The Licensee proposed to construct a fish guidance boom system that is intended to preclude downstream migrating fish from entrainment in Units 7 and 8. MDMR does not support the Licensee's proposal to use surface guidance booms at the Shawmut Project and finds them to be inadequate to protect the GOM DPS population of Atlantic Salmon and the other diadromous species in the Kennebec River. Data provided by the Licensee in the (SPP, Table 5-1) demonstrates that the guidance booms used at the Lockwood, Hydro-Kennebec, and Weston Projects do not guide 14.3-30.6% of the migrating smolts away from the turbines. Data provided by the Licensee (FLA, Table 4-22) shows that 32.7% of the downstream migrating smolts were entrained into the turbines at the Shawmut Project. The instantaneous survival was 7% lower when fish went through the turbines compared to spill routes at Shawmut and that grossly underestimates the sublethal effects, including injury and disorientation, that would result in higher mortality in the estuary. Studies at the Ellsworth dam on the Union river assessing injury to salmon showed that 22-30% of fish that went through the turbines had injuries compared to 3.8% that went through spill routes, demonstrating that impact quantitatively. The 2015 *Evaluation of Downstream Passage for Adult and Juvenile River Herring* demonstrated that 53 percent of the study fish went through the Lockwood turbines, rather than being guided by the boom to the downstream bypass, and survival was lowest for those fish passing Lockwood via the units (i.e., 77-4-81.7% survival).[4] This would indicate that performance standards would not likely be met for these species with the proposed plan.

In addition, MDMR has consulted with the USFWS regarding floating guidance booms and concurs with their comments that are provided below.

> "The Service does not know of any studies that have assessed how effective floating guidance booms are at protecting eels as they attempt to migrate downstream past a hydroelectric project. However, we do know that eels are a bottom-oriented species (Brown et al. 2009) and therefore a floating guidance boom with partial depth panels would not be fully protective. As stated in our 2019 Fish Passage Engineering Design Criteria manual, "A floating guidance system for downstream fish passage is constructed as a series of partial depth panels or screens anchored across a river channel, reservoir, or power canal. These structures are designed for pelagic fish which commonly approach the guidance system near the upper levels of the water column. While full-depth guidance systems are strongly preferred, partial-depth guidance systems may be acceptable at some sites (e.g., for protection of salmonids, but not eels)." Booms have not been implemented as a protective measure for eels or alosines anywhere else in our region, which spans fourteen states, unless they are installed with other protective measures that are suitable to ensure the safe, timely, and effective downstream passage of our trust species (e.g., inclined bar screens, angled bar racks, etc.). Therefore, the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects, as part of the current SPP process, are

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[4] Accession No. 20160331-5144

protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines."

Operational period

The Licensee proposed to operate the downstream fishway as follows:

- Continue to operate the existing forebay surface sluice gate at maximum capacity to pass up to 35 cfs from April 1 to December 31 to provide a continuous surface bypass route for downstream migrating fish.
- Continue to spill 600 cfs through the existing forebay Tainter gate from April 1 to June 15 to provide a passage route for Atlantic salmon smolts.
- Continue to provide a total of 6% of Station Unit Flow (about 400 cfs at maximum generation) through the combined discharge of the forebay Tainter and surface sluice gates from November 1 to December 31 to provide a safe passage route for Atlantic salmon kelts.
- During the interim period between license issuance and the installation of the new fish guidance boom, continue to lower four sections of hinged flashboards to pass 560 cfs via spill from April 1 to June 15 to provide a safe passage route for Atlantic salmon smolts.
- Continue to pass approximately 425 cfs through the forebay deep gate and shut down Units 7 and 8 for 8 hours during the night for 6 weeks between September 15 and November 15 for downstream adult eel passage.

This proposed downstream operational period is inadequate to safely and effectively pass all species downstream. Alewives and blueback herring leave the spawning grounds immediately after spawning and begin their downstream migration. American shad exhibit similar behavior. This downstream migration typically occurs between May and September each year. In addition, juvenile lifestages of these three species of alosines begin migrating downstream as early as July when they are only approximately 40mm long. Larger juveniles will migrate downstream as late as November depending on environmental variables freshwater nursery habitats. The Licensee has proposed to cease operation of the forebay Tainter gate after June 15th, which would leave only the forebay sluice gate in operation. The maximum capacity of the sluice gate is approximately 35cfs, which is 0.52% of station capacity and is 0.43-0.81% of average flow at the Shawmut dam between June and September.

The Licensee also mentions that they will prioritize units for protection of Atlantic salmon. Based on the average daily inflow reported in table 2 of the EA, station capacity will be exceeding in all months except July, August, and September. Therefore, station capacity will be exceeded at the project for the majority of the downstream migration of Atlantic salmon smolts and adult alosines in the spring and the majority of the juvenile alosines and adult eels in the summer and fall. While unit prioritization is proposed for these times as a protective measure, the prioritization will not be in effect as all units will be "on".

Turbine screening

The licensee did not propose any additional screening, however FERC has suggested screening may be required as this was suggested in NMFS Section 18 preliminary prescription. The preliminary screening suggestion is to equip each powerhouse with full-depth trash rack bars clear spaced at 1.5-inches and 3.5-inches for Units 1-6 and 7-8 respectively. This screening approach is inadequate for Atlantic salmon and does not take into account juvenile river herring, shad, sea-lamprey, or eels so will not result in safe downstream passage of indigenous species. In order to protect downstream migrating Atlantic Salmon smolts and kelts, adult and juvenile Alewife, adult and juvenile American Shad, adult and juvenile Blueback Herring, and adult American Eel, and adult and juvenile sea-lamprey, the Licensee would need to install full-depth inclined or angled screening with much smaller spacing and sized so that the normal velocities should not exceed 2 feet per second measured at an upstream location where velocities are not influenced by the local acceleration around the guidance structures.

Non-Attainment

MDMR notes that aquatic life monitoring in the Shawmut impoundment indicates a finding of non-attainment ME0103000306_339R_01. https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

Conclusion

The proposal by the Licensee will have significant adverse impacts to fisheries habitat and aquatic life and does not provide sufficient protections for indigenous species. Many additional items, such as full depth appropriate screening, a second volitional fishway near a major area of attraction flow on river right, and reliance on other best protective practices and available science should be considered further.

August 25, 2021

UNITED STATES OF AMERICA

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Brookfield White Pine Hydro, LLC	Project No. 2325-100
Merimil Limited Partnership	Project No. 2574-092
Hydro-Kennebec, LLC	Project No. 2611-091

KENNEBEC COALITION'S AND CONSERVATION LAW FOUNDATION'S JOINT MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS IN OPPOSITION TO THE AMENDMENT APPLICATION TO INCORPORATE SPECIES PROTECTION PLAN INTO THE PROJECT LICENSES

This Motion to Intervene, Protests, Comments, including demand for Commission compliance with the National Environmental Policy Act, 42 U.S.C. § 4321 et seq., and Request for Orders of Plans for Decommissioning, are filed by the Kennebec Coalition and Conservation Law Foundation pursuant to the Notice of Amendment Application to Incorporate Species Protection Plan into the Project Licenses and Soliciting Comments, Motions to Intervene, and Protests, issued by the Federal Energy Regulatory Commission ("Commission" or "FERC"), on July 26, 2021. The amendment application was filed by Brookfield Power US Asset Management, LLC ("Brookfield") on behalf of the affiliated licensees of three hydroelectric projects on the Kennebec River in Maine – the Lockwood Project FERC No. P-2574, the Hydro-Kennebec Project FERC No. P-2611, and the Weston Project FERC No. P-2325.

In accordance with the Notice and the Commission's Rules of Practice and Procedure, 18 C.F.R. §385.210, .211 and .214, the Atlantic Salmon Federation U.S.

("ASF"), the Kennebec Valley Chapter of Trout Unlimited ("KVTU"), the Natural Resources Council of Maine ("NRCM"), Maine Rivers (hereinafter collectively referred to as the "Kennebec Coalition"), and the Conservation Law Foundation ("CLF"), hereby move to intervene in the above-captioned proceeding and to protest and comment on the amendment application that has been filed with the Commission for these Projects.

1. MOTION TO INTERVENE

The Kennebec Coalition is a longstanding coalition of non-profit organizations consisting of the Atlantic Salmon Federation U.S.; the Kennebec Valley Chapter of Trout Unlimited; the Natural Resources Council of Maine; and Maine Rivers. Each member, except Maine Rivers, is a signatory to the *Agreement Between Members of the Hydro Developers Group, the Kennebec Coalition, the National Marine Fisheries Service, the State of Maine, and the U.S. Fish and Wildlife Service ("Agreement")* dated May 27, 1998 ("The KHDG Agreement").[1] Kennebec Coalition members have long been involved with all aspects of the protection and restoration of the Kennebec River, including filings with the Commission on matters involving the implementation of the KHDG Agreement.[2]

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[1] A Commission order issued on September 16, 1998, approved the KHDG Agreement and incorporated its fish restoration goals and fish passage provisions into the licenses of the four projects – Lockwood, Hydro-Kennebec, Shawmut, and Weston. *Edwards Manufacturing Co., Inc., and City of Augusta, Maine*, 84 FERC ¶ 61,227 (1998) (incorporating May 27, 1998 Lower Kennebec River Comprehensive Settlement Record (KHDG Agreement)).

[2] The KHDG Agreement, Part I(B), coins the term "Kennebec Coalition" to name the respective associations herein, to wit: "the Atlantic Salmon Federation; Kennebec Valley Chapter of Trout Unlimited; the Natural Resources Council of Maine; and Trout Unlimited." 84 FERC ¶ 61,227 & n.1. Maine Rivers has since joined the Kennebec Coalition in filings before this Commission, as Maine Rivers was formed in 2002 after the KHDG Agreement was signed and approved by the

Members of ASF, KVTU, Maine Rivers and NRCM use the Kennebec River for recreational, educational, and aesthetic pursuits. Their members fish, boat and otherwise enjoy the watershed in the vicinity of the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects along the Kennebec. Further, Kennebec Coalition members have broad and deep organizational interests in the Commission's equal consideration of power and non-power values in hydropower licensing pursuant to Sections 4(e) and 10(a) of the Federal Power Act ("FPA"). Finally, as signatories to the KHDG Agreement, ASF, NRCM, and KVTU and their members have an interest in upholding and enforcing the terms of the KHDG Agreement and the fish restoration goals incorporated into the Project licenses and present in this proceeding.

Specific descriptions of the moving-party Intervenors joining herein, is as follows:

(a) The Atlantic Salmon Federation U.S. ("ASF"), is a 73-year-old international non-profit organization dedicated to conserving and restoring wild Atlantic salmon and the ecosystems on which their well-being and survival depends. ASF and its Maine Council represent a dozen angling, conservation, and watershed education organizations in the State of Maine and more than 5,000 members and volunteers in the United States. ASF has been engaged on Kennebec River fisheries and dam issues for more than a quarter of a century and has devoted substantial time and money in efforts to restore Atlantic salmon and other native sea-run fish in the Kennebec River Watershed. This includes supporting the removal of the Edwards, Fort Halifax and Madison Electric Works Dams and contributing to the efforts of the

Commission. *See, e.g.,* FERC Order, FERC Accession No. 20200713-3034 (July 13, 2020) at ¶ 14.

State of Maine in the Sandy River (a major tributary of the Kennebec River that enters the main stem of the river near Madison) to restore the endangered Atlantic salmon population utilizing innovative in-stream egg rearing techniques. ASF is currently implementing a $2.5 million restoration initiative on Temple Stream, a major tributary of the Sandy River, involving the removal of the only dam on the stream and the replacement of two road-stream crossings. Once completed in 2022, ASF's work will fully restore access to more than 50 miles of high-quality, designated critical habitat for endangered Atlantic salmon. In addition, ASF has substantial scientific expertise in Atlantic salmon biology and management and the ecological interactions between salmon and other sea-run fish species. Finally, as a signatory to the KHDG Agreement, ASF has a fundamental interest in ensuring that the outcome of the current proceeding is consistent with the terms of the Agreement.

(b) Kennebec Valley Chapter of Trout Unlimited ("KVTU") is one of six Maine chapters of Trout Unlimited, a national conservation organization whose mission is to conserve, protect and restore North America's cold water fisheries and their habitat. KVTU members fish and recreate on the Kennebec River and its tributaries, have deep knowledge of the river and its fisheries, and have long been involved in fisheries conservation and restoration in the Kennebec watershed. KVTU worked with the Maine Department of Marine Resources ("MDMR") to initiate the current egg-planting project in the Sandy River that is the basis for salmon restoration in the Kennebec watershed; played a leading role in the removal of the Madison Electric dam, which opened the entire mainstem Sandy River to passage for endangered Atlantic salmon and other sea-run fish species; and advocated for the removal of the Fort Halifax dam to open the Sebasticook River to fish passage. KVTU demonstrated its interest in the Kennebec River watershed and its restoration, as a separate signatory to the KHDG Agreement with Trout Unlimited, and by KVTU's participation in Commission proceedings relating to the KHDG Agreement.

(c) Maine Rivers is a nonprofit corporation with a mission to protect, restore and enhance the ecological health of Maine's river systems. For close to two decades, Maine Rivers has worked to achieve its mission and has shown a strong interest in the recovery of the Kennebec River, including through the successful organization of the Maine Rivers conference on the Kennebec in 2014, entitled Restoring Fish for People and Wildlife, an event bringing together more than 100 people to focus on the restoration of sea-run species.

(d) NRCM is a 62-year-old environmental advocacy organization with over 25,000 members and supporters. NRCM's mission is "to protect, conserve and restore Maine's environment, now and for future generations." NRCM members, staff, and the board of directors all have significant interests in the Kennebec River watershed through their use, enjoyment, and research of this area. NRCM was previously an intervenor and participant in the settlement of the Edwards Project proceedings, which had resulted in the Commission's order denying a new license of the Edwards Project (81 FERC ¶ 61,255), removal of the Edwards dam, and incorporation of the KHDG Agreement fish passage terms into the subject licenses of the next four hydroelectric projects in the lower Kennebec watershed, in *Edwards Manufacturing Co., Inc., and City of Augusta, Maine*, 84 FERC ¶ 61,227. NRCM has demonstrated long-standing interest in the recovery of Kennebec fisheries in general, including through its comments and efforts to fully implement the KHDG Agreement and to otherwise ensure the restoration of the Kennebec River and its fisheries. NRCM has both individually and as a member of the Kennebec Coalition, demonstrated an active interest in the fisheries restoration activities on the Kennebec River and watershed. NRCM has demonstrated this interest through activities including but not limited to participation in the development and review of the Kennebec Hydro Developers Group Annual Reports, continuing outreach and policy efforts regarding restoration of the Kennebec River and its fisheries, advocacy to improve water quality in the Kennebec, and activities related to the licenses for hydropower projects that are governed by the KHDG Agreement.

(e) Founded in 1966, CLF is a non-profit advocacy organization with 5000 members across New England, including approximately 500 in Maine. CLF works to solve the environmental problems threatening the people, natural resources, and communities of New England. CLF's advocates use law, economics and science to design and implement strategies that conserve natural resources, protect public health, and promote vital communities in our region. CLF has members in many of the communities that border the Kennebec River, including Waterville, Augusta, Skowhegan and Fairfield, the sites of these Projects. For more than three decades, CLF has worked to restore habitat in New England's coastal rivers for important species such as herring, alewives, shad and salmon. CLF's work to restore key forage fish has stretched from the Connecticut River to the St. Croix River and is an integral part of our work to restore New England's coastal and ocean fisheries. Members of CLF use the Kennebec River for recreational, educational, and aesthetic pursuits. CLF members fish, boat and otherwise enjoy the watershed in the vicinity of the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects along the Kennebec. Further, CLF members have broad and deep organizational interests in the Commission's equal consideration of power and non-power values in hydropower licensing pursuant to Sections 4(e) and 10(k) of the Federal Power Act ("FPA"). CLF is engaged on Kennebec River fisheries and dam issues in collaboration with the Kennebec Coalition, a group of organizations who themselves have been working for more than a quarter of a century to restore Atlantic salmon and other native sea-run fish in the Kennebec River Watershed. This collaboration resulted in the joint filing by the Kennebec Coalition and the CLF of Protests and Comments in opposition to the Draft Environmental Assessment for the Shawmut Project Hydropower License.[3] This collaboration also results in the present joint filing.

2. KENNEBEC COALITION and CLF PROTESTS, COMMENTS, AND DEMAND FOR COMPLIANCE WITH NATIONAL ENVIRONMENTAL POLICY ACT ("NEPA"); and REQUEST FOR ORDERS OF PLANS FOR DECOMMISSIONINGS

I. Introduction

Brookfield Power US Asset Management, LLC ("Brookfield"), on behalf of the affiliated licensees for the Lockwood (P-2574), Hydro-Kennebec (P-2611), and Weston (P-2325) Projects, has requested Commission approval to amend each project license – for the remaining duration of each license – to incorporate the provisions of a Species Protection Plan for Atlantic salmon, Atlantic Sturgeon, and shortnose sturgeon ("SPP").

[3] FERC Accession No. 20210816-5050.

The SPP was filed concurrently with a Draft Biological Assessment ("BA"), which the Commission has adopted without modification as the final BA for initiation of a request for formal consultation under Section 7 of the Endangered Species Act ("ESA").[4] The proposed actions of the SPP and BA include, *inter alia*, construction and operation of permanent upstream and downstream fish passage facilities, and related operational measures, at each of the three Projects. The license amendments would incorporate these proposed actions and govern "continued operation of the projects on GOM DPS Atlantic salmon and is designated critical habitat."[5] The expirations of the FERC licenses for the subject Projects are year 2036.[6]

The Kennebec Coalition and CLF have reviewed the SPP, and conclude that these plans will result in the likely extirpation of Atlantic salmon from the Kennebec River, and will result in the continued failure of restoration efforts for other sea-run species above Waterville (where the Lockwood Project is located). The plans will jeopardize the survival and recovery of Atlantic salmon, and will defeat, for decades and potentially into perpetuity, all meaningful efforts to reach the restoration goals of the Maine Department of Marine Resources ("MDMR") for both salmon and the suite of sea-run species within the critical habitat of the Kennebec River, and within the Merrymeeting Bay species habitat recovery unit, including the Sandy River critical habitat units (Merrymeeting Bay

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[4] FERC Accession No. 20210726-3031.

[5] *Id*. at p. 2, under "Proposed Action."

[6] SPP at 1.1, p. 1-1 [FERC Accession No. 20210601-5152]. As the Commission is aware, the Shawmut Project (P-2322), is the third project upriver, located between the Hydro-Kennebec Project (P-2611) and the Weston Project (P-2325). The Shawmut licensee is also Brookfield White Pine Hydro LLC, part of the Brookfield licensee affiliates. Shawmut is under review for relicensing (P-2322-069), and its current license expires on January 31, 2022.

SHRU).[7] Further, Brookfield's plan contains significant amounts of inaccurate information, as detailed in each of the sections below.

Brookfield's plans – the SPP and the measures set forth in the adopted BA – are not based on any current best available data; indeed the current best available data yield the unassailable consensus that engineered fish passage facilities will not work. They will not work even at the unsupported percentage passage efficiencies proffered by Brookfield for both up- and downstream measures; and for either Atlantic salmon or American shad, those passage efficiencies have never worked at such levels on any multi-dam system, anywhere on our planet. Based on this plan, the National Marine Fisheries Service (NMFS) and this Commission should find that these planned continued operations of Brookfield's four projects will result in jeopardy to the survival and recovery of GOM DPS of Atlantic salmon. 16 U.S.C. §§ 1531, et seq. The plan would also leave each of the three projects at issue in non-compliance with the fish passage standards of each current license, and the water quality standards applicable to each project under the Clean Water Act, 33 U.S.C. § 1341, with respect to mandates for passage of other sea-run species en masse, which are critical both to the survival and recovery of Atlantic salmon, and to the ecosystem as a whole.

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[7] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322). Hydroelectric Project, State Water Quality Certification. July 17. p. 2. Accessible at https://www.maine.gov/dep/ftp/HYDRO/WaterQualityCertifications/Shawmut/agency-comments/DMR%20Comments%20to%20DEP%20WQC%20Shawmut_July.pdf. Also attached to these Comments.

A. The Notice of License Amendment Application sets forth proposed actions requiring review under NEPA.

The Notice of License Amendment Application in issue here is the type of federal agency action that triggers compliance with the National Environmental Policy Act of 1969 ("NEPA"), 42 U.S.C. § 4321 et seq. "At its core, NEPA simply requires that federal agencies consider the environmental consequences of their actions."[8] "Under NEPA, agency decisionmakers must identify and understand the environmental effects of proposed actions, *and they must inform the public of those effects so that it may 'play a role in both the decisionmaking process and the implementation of [the agency's] decision*.'"[9] "In other words, 'NEPA was designed 'to insure a fully informed and well-considered decision.'"[10]

Under the regulations promulgated by the Council on Environmental Quality, guiding federal agencies' compliance with NEPA, in assessing "whether NEPA applies or is otherwise fulfilled," a Federal agency should determine "whether the proposed activity or decision is a major Federal action."[11] The regulations provide that "in

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8 *WildEarth Guardians v. Zinke*, 368 F. Supp. 3d 41, 52 (D.D.C. 2019) (citing NEPA, 42 U.S.C. §§ 4321-4370h; 40 C.F.R. § 1501.1).

9 *Id*. (italics emphasis added) (quoting in part *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989)); *see also* 42 U.S.C. § 4321; 40 C.F.R. § 1501.1.

10 *Id*. (quoting in part *Park Cty. Res. Council, Inc. v. U.S. Dep't of Agric.*, 817 F.2d 609, 621 (10th Cir. 1987) (quoting *Vt. Yankee Nuclear Power Corp. v. Nat. Res. Def. Council, Inc.*, 435 U.S. 519, 558 (1978)).

11 40 C.F.R. § 1501.1(a)(4). We cite the current regulations, effective as of September 14, 2020; however, the authorities on the position set forth herein are consistent whether under the new regulations or CEQ's 1978 regulations. Under the new regulations, "Section 101 of NEPA establishes the national environmental policy of the Federal Government to use all practicable means and measures to foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans." 40 C.F.R. § 1500.1(a).

particular, [NEPA] requires Federal agencies to provide a detailed statement on proposals for major Federal action significantly affecting the quality of the human environment."[12]

There should be no question that the proposed actions and FERC decision-making at issue here constitute a major action significantly affecting the quality of the human environment. Indeed, even for only *one* of the dams in issue in this four-dam system (Shawmut P-2322), the Commission has in fact engaged NEPA procedures, albeit by issuance of a deficient Draft EA recently issued by Commission staff. In that context other Federal natural resource agencies had requested that an Environmental Impact Statement issue under NEPA, in relation to the Shawmut relicensing alone.[13] Certainly a three-dam plan to cover continuing operations in the same river, with projects on either side of Shawmut, is a major federal action that triggers NEPA procedure.

We also must not ignore the context of the proposed actions that involves considering continued operations of these three projects within the 4-project system *for the duration of their licenses to 2036*. When even a Draft EA has issued for the Shawmut Project proposed to operate (if relicensed over our objections and over the recommendations of NMFS and MDMR under the Federal Power Act) until 2052, certainly a comprehensive NEPA analysis of the other three projects within the system –

[12] 40 C.F.R. § 1500.1(a).

[13] USFWS, NMFS and MDMR all called for preparing an EIS rather than an EA with respect to Shawmut relicensing: Letter to Vince Yearick, Director , Division of Hydropower Licensing, FERC, from Anna Harris, Project Leader, Maine Field Office, Fish and Wildlife Service, United Sates Department of the Interior, August 9, 2017 [**FERC Accession No. 20170809-5067**]; Letter to Secretary Bose, Federal Energy Regulatory Commission from Julie Crocker, ESA Fish Recovery Coordinator, (NMFS Greater Atlantic Regional Fisheries Office), August 16, 2017 [**FERC Accession No. 20170816-5134**].("given the existing information on project effects, we recommended that FERC analyze the impacts of the project by preparing an EIS, rather than an EA."); Letter to Secretary Bose, Federal Energy Regulatory Commission from Patrick C. Keliher, Commissioner, MDMR, August 9, 2017 [**FERC Accession No. 20170817-5120**] ("However, given the existing information on project impacts, summarized below, we recommend that the Commission analyze the impacts of the project by preparing an EIS, rather than an EA.").

all operating under a set of affiliated licensees (Brookfield) – is compelled here. To perform a NEPA analysis for Shawmut, even in faulty Draft EA form, and yet to ignore NEPA altogether for Lockwood, Hydro-Kennebec, and Weston, is inconsistent with the NEPA mandate.

Nor is it enough to say that the ESA section 7 consultation will inevitably cover whatever NEPA requires. That was not the case with Shawmut, which is simultaneously undergoing both NEPA procedure and the required section 7 consultation under the ESA with NMFS with respect to Atlantic salmon. The SPP and BA here do not perform a comprehensive basin-wide analysis that would include Shawmut, as NEPA would require.[14] Further, one of the fundamental failings of this SPP and Biological Assessment is that they completely ignore the requirements of fish passage for the other sea-run species which are part of the environment, and which are part of Brookfield's responsibility for passage and restoration. In other words, this SPP and BA proposes (unrealistically) to pass Atlantic salmon, notably at the expense of all of the other species. While that failing may be a significant factor in a finding of jeopardy under the ESA, it is also a significant and notable environmental consequence that the Commission is otherwise compelled to "take a hard and honest look at" under NEPA's primary "information-forcing" function.[15]

[14] *Delaware Riverkeeper Network v. FERC*, 753 F.3d 1304, 1313-15 (D.C. Cir. 2014) (FERC impermissibly segmented NEPA review of a third project when it failed to consider the cumulative impacts of all four upgrade projects); *see also American Rivers v. Federal Energy Regulatory Commission*, 895 F.3d 32, 49 (D.C. Cir. 2018).

[15] *American Rivers v. Federal Energy Regulatory Commission*, 895 F.3d 32, 49 (D.C. Cir. 2018) (citing *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc*., 435 U.S. 519, 518 (1978); *Sierra Club v. FERC*, 867 F.3d 1357, 1367 (D.C. Cir. 2017); *Mayo v. Reynolds*, 875 F.3d 11, 16 (D.C. Cir. 2017).

It is also important for the Commission to be reminded that it had always been the intention that the environmental consequences of this SPP be analyzed comprehensively with the environmental consequences of Shawmut relicensing. That intention was contained in the very proceedings leading up to this Notice of Amendment of License, as early as the Commission's designation of non-federal representative status to Brookfield under the ESA.[16] The non-federal designation was premised upon Brookfield's promise to "file a basin-wide SPP in January 2019, concurrent with the Final License Application submission for the Shawmut Project." The Commission even stated that "[t]his should allow sufficient time to complete the FERC Section 7 consultation process and the BO [Biological Opinion] issuance **prior to the December 2019 expiration**."[17] This promise of a comprehensive review echoes throughout this record, including 1) when the Commission extended the Shawmut Project license term, stating that "Brookfield is currently in the process of developing a final BA and [SPP] for Atlantic salmon *for the four lower Kennebec River projects*" and extending the Shawmut license term would "allow Brookfield to complete the BA and SPP for the protection of Atlantic salmon;"[18] and 2) when the Commission extended the expiration of the Hydro-Kennebec Interim SPP by three years, so that it would expire on December 31, 2019 "to align it with the expiration date of the Interim SPP approved for the Lockwood, Shawmut, and Weston Projects," which in turn would "permit the development of a single Final SPP for all four projects, which would enable the licensees and resource agencies to follow a more

[16] FERC Accession No. 20180212-5110.

[17] *Id*. at p.2.

[18] FERC Accession No. 20181211-3042 at ¶¶ 4 & 8 (italics emphasis added).

effective and efficient 'basin-wide' approach for Atlantic salmon species protection on the Kennebec River . . . ."[19]

NEPA procedure and analysis compel this *comprehensive* review – one that involves all projects on the river, and involving *all* sea-run fish species effected by each projects' adverse impact to the environment.[20] "The agency must also consider the unique characteristics of the geographic area, the cumulative effects of each individual part of the action, and any impact on endangered or threatened species or their habitats."[21]

The Commission's decision-making in this instance – the determination on whether to amend each project license, in the context where each license currently has long-expired ESA incidental take authorizations, and where each license runs to 2036 – is an agency action clearly of environmental significance, both in context and in intensity of impact.[22] NEPA review, to ensure a "'well-considered' and 'fully informed' analysis of the relevant issues and opposing viewpoints," is both essential and mandatory.[23]

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[19] FERC Accession No. 20180920-3040 at ¶ 8.

[20] *American Rivers v. Federal Energy Regulatory Commission*, 895 F.3d 32, 49 (D.C. Cir. 2018).

[21] *Id*.

[22] *Id*. at 49 (citing 40 C.F.R. § 1508.27).

[23] *Id*.

B. Brookfield's upstream performance standards are unrealistic, and Brookfield has provided no data supporting its ability to attain them.

i. Brookfield's proposed 96% upstream salmon passage standard for each of the three dams is unrealistic, and we are unaware of other dams that meet this standard.

In its SPP, Brookfield proposes a 96% upstream passage standard for Atlantic salmon for each of the three dams[24] and an "end-of-pipe" standard of 84.9%.[25] There is no justification for these proposed standards in peer-reviewed literature; in fact, extensive research shows that such standards have never been consistently reported within 48 hours of approach at any dam, on any river in the world.

While high passage success has been achieved at some hydropower dams, such as the Milford Dam on the Penobscot River in Maine, the Finsjö Dam on the Emån River in Sweden, and the Herting Dam on the Ätran River in Sweden, delays are quite common and passage is highly variable between years (Dauble and Mueller, 1993; Calles and Greenberg, 2006; Caudill et al., 2007; Holbrook, 2009; Noonan et al., 2012; Sigourney et al., 2015).[26] The reality of passage effectiveness standards is not rosy. An extensive review of upstream salmonid passage studies revealed a mean passage efficiency of 61.7% (Noonan et al., 2012). Analyses of cumulative success passing multiple dams, as is required to reach spawning grounds above the Kennebec/Sandy River confluence in this case, are even greater cause for concern, with numbers well below 50% (Holbrook et al., 2009; Gowans et al., 2003; Stevens et al., 2019). And, when passage at several dams

[24] SPP at P.1-11; FERC Accession No. 20210601-5152.

[25] SPP at P. 8-2.

[26] A List of References to literature cited in these Comments is appended.

is required for successful migration, the cumulative effect of even slightly reduced passage at these dams can be substantial (Holbrook et al., 2009).

The passage rate at the Milford Dam is also not as good as it appears. Brookfield's SPP ignores serious, self-reported delays in salmon passage at Milford during tagging studies of adult passage. At Milford in 2014, according to Brookfield's own data, 95% of tagged salmon that approached within 200 meters of the Milford Dam failed to pass the fish lift within the required timeframe of 48 hours.[27] Again in 2015, according to Brookfield's own data, 83% of the tagged adult salmon did not pass the fish lift within 48 hours in a 2015 study.[28] University of Maine researchers also found in a 2015 study that 65% of adults did not pass the fish lift within 48 hours.[29]

These delays are biologically significant, which the SPP does not recognize, as discussed below.

ii. The biological significance of delays in upstream passage

Delays in upstream migration at dams can be extensive – up to 52 days reported by Gowans et al. (2003) – and these delays have the potential to devastate a population and erase any potential passage successes. Delays reduce survival and spawning success by increasing vulnerability to parasites and predation, depleting energy reserves, and

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[27] HDR Engineering. 2015. ATLANTIC SALMON PASSAGE STUDY REPORT ORONO, STILLWATER, MILFORD, WEST ENFIELD, AND MEDWAY HYDRO PROJECTS. P. 58. October. FERC Accession No. 20150324-5214.

[28] Kleinschmidt. 2016. 2015 ADULT ATLANTIC SALMON UPSTREAM PASSAGE STUDY MILFORD HYDROELECTRIC PROJECT. P. 21. May. FERC Accession No. 20160531-5663.

[29] Kleinschmidt. 2016. 2015 ADULT ATLANTIC SALMON UPSTREAM PASSAGE STUDY MILFORD HYDROELECTRIC PROJECT. P. 21. May. FERC Accession No. 20160531-5663.

creating missed spawning opportunities (Geist et al., 2000; Calles and Greenberg, 2009; Holbrook et al., 2009; Nyqvist et al., 2017(3); Izzo et al., 2016). The dangers of each of these possible outcomes is particularly alarming for the individuals that make up small populations, as in the case of the Kennebec's small endangered Atlantic salmon population.

Caudill et al. (2007) found that fish may ultimately be successful in passing one or more dams, but never make it to spawning grounds; this was attributable to the delayed passage at the dams. Geist et al. (2000) predicted that salmonids delayed more than five days passing each dam would have insufficient energy reserves to complete spawning, because migrating adults rely on energy reserves obtained in marine environments. When those energy reserves obtained from the marine environment are depleted by delays in reaching spawning habitat, spawning cannot be completed or is impaired because of insufficient energy reserves (Geist et al., 2000). Best current information and scientific literature also emphasizes the critical importance of repeat spawners – older, larger, repeat spawning fish are critical for population resilience and therefore recovery.[30]

Fungal infections in fish that failed upstream dam passage reported in Conon River in Scotland (Gowans, 2003) were attributed to combined stress of handling and accumulating with other fish below the dam. Similar results were found for steelhead trout and chinook salmon on the Columbia River associated with head burns and cranial lesions (D.A. Neitzel et al., 2004).[31] Holbrook et al. (2009) observed frequent fallbacks

[30] Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7. This communication is attached to these Comments. This current information is discussed further in Part C.iv. herein.

[31] Likewise, injuries to delayed salmon "rescued" at the Lockwood Project (FERC No. 2574) in June of this year, are fully and vividly documented. FERC Accession No. 20210701-5242 (Attachment 1, Maine

into estuary among adults that failed to pass dams. They associated fallbacks with temperatures exceeding 22°C, suggesting the fallbacks to be a coping mechanism for thermal stress and migratory delays.

Even after substantial remediation efforts – replacing a technical fishway with a nature-like pool fishway – increased overall passage success to 97% from the 72% seen with the Denil fish pass, more fallbacks were reported by Nyqvist et al 2017(3). Fallbacks can cause lethal or sublethal injuries, delay or terminate migration or simply demand greater energy expenditure which has the potential to harm spawning success (Dauble and Mueller, 1993; Geist et al., 2000; Holbrook et al., 2009). Rubenstein found that Atlantic salmon experience extensive delays before passing the Lockwood Dam on the Kennebec. These delayed salmon lose more energy stores – compared to salmon that successfully reach cooler upstream habitat – due to the need to thermoregulate and/or seek-out coldwater refugia in order to survive the increased and prolonged exposure to higher water temperatures that exist below the dam. This additional expenditure of energy causes increased pre-spawning mortality, decreased spawning success, and increased loss of iteroparity from the population.[32]

This information shows that the 96% upstream passage rate that the SPP proposes is not attainable at even one dam, let alone at four dams in sequence.

Department of Marine Resources (Jennifer Noll). June 17, 2021. Field Summary of Atlantic Salmon Stranding Rescue at Lockwood Dam.)

[32] Rubenstein, S.R. Energetic impacts of delays in migrating adult Atlantic salmon. August 6, 2021 Presentation (discussed in Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7, and attached hereto).

iii. The proposed bypass reach fishway at Lockwood is completely inadequate.

MDMR expressed numerous concerns with Brookfield's fishway proposal, including that fishways are very unlikely to meet necessary passage standards for target fish species; that this particular fishway may result in passage failure due to the creation of an eddy at the second turning pool; that Brookfield's computational fluid dynamics (CFD) modeling did not account for flows during the bulk of the fish passage migration season; and that all of Brookfield's CFD modeling may be invalid due to changes the Maine Department of Transportation may make to supports to the Route 201 bridge.[33]

C. Brookfield's downstream smolt passage goals are also unrealistic, and Brookfield's own data show that it will never meet these goals.

i. Brookfield's own data show that downstream passage success is far lower than it claims.

Brookfield claims it will meet a passage goal of 97% of smolts at each of the three dams for an overall "end-of-pipe" passage rate of 88.5% across all four dams.[34] However, Brookfield's own data show that 97% downstream passage is not attainable at any of the four lower Kennebec dams and neither is an overall survival rate of 88.5% over all four of the dams. On behalf of the Kennebec Coalition, Don Pugh, a fish passage expert with decades of experience, including at the S.O. Conte Anadromous Fish Research Center,[35] evaluated Brookfield's downstream smolt passage data from 2012 to 2015 and identified two key factors that inflated Brookfield's smolt survival percentages.

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[33] MDMR. 2021. Comments of the Maine Department of Marine Resources (MDMR) for #L-20218- 35-O-N Permit Application for Lockwood Fishway Construction. March 10. P. 3. Accessed at https://www.maine.gov/dep/ftp/HYDRO/MWDCA/Lockwood/fishway/agency-review/2021_03_10_Lock_Fishway_DMR%20comments.pdf.

[34] SPP at P.8-1; FERC Accession No. 20210601-5152.

[35] Mr. Pugh's curriculum vitae is attached to these Comments.

First, Normandeau (Brookfield's consultant) inappropriately used paired release studies when analyzing the 2013 to 2015 data (Normandeau, 2014-2016); paired release studies should only be used when there are at least 1000 fish.[36] Using this methodology with the small numbers of Atlantic salmon smolts in the Kennebec, as Brookfield's consultant did, actually "creates fish" statistically, with calculated survival rates exceeding the number of fish that actually survived.[37] The SPP ignores this significant flaw in Normandeau's analysis.[38]

Second, Brookfield inappropriately calculated overall downstream survival rates as the product of survival rates at each individual dam, which leaves out the highly significant impacts of the impoundments between the dams. Mr. Pugh analyzed the actual survival of individual smolts from 200 meters above the Weston Dam to the lowermost telemetry station below the Lockwood Dam. Only an average of 56% of smolts survived this multi-dam passage over the course of the four years of the Normandeau studies.[39] This is likely an overestimate of survival because Normandeau released smolts just above the Weston Dam, excluding the likely significant impacts on smolt survival of the long Weston impoundment, which is approximately 12 miles long.

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[36] Zydlewski, J., D. Stich and D. Sigourney. 2017. Hard choices in assessing survival past dams – a comparison of single- and paired-release strategies. Can. J. Fish. Aquat. Sci. 74(2): 178-190.

[37] Kennebec Coalition. 2020. MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS OPPOSING THE ISSUANCE OF A NEW LICENSE FOR THE SHAWMUT PROJECT NUMBER 2322-069, WITH RECOMMENDATION FOR ORDER OF PLAN FOR DECOMMISSIONING AND REMOVAL. P. 41. FERC Accession No. 20200831-5332.

[38] *Id*.

[39] Kennebec Coalition. 2020. MOTION TO INTERVENE, WITH PROTESTS AND COMMENTS OPPOSING THE ISSUANCE OF A NEW LICENSE FOR THE SHAWMUT PROJECT NUMBER 2322-069, WITH RECOMMENDATION FOR ORDER OF PLAN FOR DECOMMISSIONING AND REMOVAL. P. 38. FERC Accession No. 20200831-5332.

Based on Mr. Pugh's calculations, Brookfield's contention that it can meet an "end-of-pipe" downstream passage goal of 88.5% is both absurd and perilous for the future of the endangered Atlantic salmon.

In order to understand the effect of a 24-hour downstream passage requirement, Brookfield included a paired release analysis of downstream survival that considered fish that did not pass within 24 hours as mortalities. These results are called 'adjusted'. Table 1 (below) compares the baseline (all fish that passed) and adjusted results for the years 2013 to 2015.

Table 1. Comparison of baseline and adjusted survivals for Weston, Shawmut, Hydro-Kennebec, and Lockwood projects by year and averaged.

	Weston		Shawmut		Hydro-Kennebec		Lockwood	
Year	Base	Adj	Base	Adj	Base	Adj	Base	Adj
2013	95.7	79.7	96.3	83.2	94.1	88.1	100	93.7
2014	89.5	86.4	93.6	88.5	98.0	90.0	97.7	94.6
2015	99.7	66.0	90.6	83.8	n/a	n/a	98.0	88.8
Mean	95.0	77.4	93.5	85.2	96.1	89.1	98.6	92.4

When fish that did not pass within 24 hours are considered mortalities, **even with** a paired release analysis, survival is far below the 96% downstream bypass standard of Brookfield's SPP, ranging from 3.6% to 18.6% lower than the standard. As noted above, these are survivals for fish passing only one dam and do not consider the effect of passing four dams, as wild smolts must, or of the effect of passing approximately 27 miles of impounded river (which is 86% of the river from the head of the Weston impoundment to the Lockwood project).

The impact of passing multiple dams can be seen in the numbers of fish that were released above Weston, and in the Weston tailrace, that passed Lockwood in 2014 and

2015 (Normandeau 2015 & Normandeau 2016, Report Tables 7-4 and 6-4 respectively). Of the 158 fish released at the Weston project in 2015 (98 released above Weston to face passing four dams; and 60 released below Weston to face passing three dams), only 100 were detected below Lockwood (63.3%). In 2014 with similar numbers above and below Weston, 81.8% of the fish released at Weston were detected below Lockwood for a two-year average of only 72.6%. Survival to below Lockwood of fish released at Weston, Shawmut, Hydro-Kennebec, or Lockwood in 2014 of 81.8%, 86.9%, 94.1% and 99.0% clearly reveal the effect of passing multiple dams (Report Table 7-7, Normandeau 2015): Survival decreases as the number of dams passed increases (*see also* Stich et al. 2015).

Brookfield's SPP also fails to give adequate consideration to delayed mortality of smolts that survive immediate passage at each dam but suffer increased mortality as they continue their migration beyond the immediate tailrace. Research on the Penobscot River assessing survival of tagged smolts found that the number of dams passed by a salmon smolt had a "strong negative effect of fish survival in the estuary."[40] Building on these empirical results, Stevens et al. modeled salmon smolt survival through multiple Penobscot River dams and showed a clear negative correlation between predicted smolt survival and the number of dams encountered, concluding that "up to 37% of the annual loss of hatchery smolts was attributed directly to dams."[41] They also analyzed the increase in survival from the Penobscot River Restoration Project, which removed the lowest dams on the Penobscot River, and concluded that "a 36% increase (from

[40] Stich et al. 2015 at pp. 68-86.

[41] Stevens et al. 2019 at pp. 1795–1807.

unrestored) in wild smolt survival to the ocean was possible with the removal of some dams in the Penobscot River."[42]

In addition, as Dr. Robert Lusardi noted in his review of the Draft EA for the Shawmut Project:

> Delayed mortality has been found to have a profound effect on juvenile salmon survival when smolts must migrate downstream through dams and has been tied to the hydrosystem experience (Budy et al. 2002). Typically, mortality occurs after passage through, over, or around a dam, but does not become evident until those individuals reach the estuary or ocean (Budy 2002). The draft EA neglects to examine the potential for delayed mortality to play a significant role in survival estimates of juvenile salmon through the Shawmut project. Budy et al. (2002) demonstrated that as a fish passes through a dam, they experience acute or chronic stress. While some individuals may fully recover, others do not and experience physical limitations making them more susceptible to mortality at a later point in time (e.g., more susceptible to predators, disease, or energetic and/or physiological impairment). For instance, Ferguson et al. (2006) found that while initial survival estimates of juvenile Pacific salmon passage through McNary Dam in the Pacific Northwest ranged from approximately 86-95%, delayed mortality ultimately accounted for 46-70% of total estimated mortality. The authors concluded that the primary mechanism of delayed mortality was sensory impairment and subsequent predation in and around the dam tailrace.[43]

These statements from Dr. Lusardi are equally relevant to the three dams in the SPP.

ii. Brookfield's proposed "improvements" to downstream passage will not allow it to meet its proposed smolt passage goals nor will they assure safe passage of other sea-run species.

Brookfield proposes various tweaks to downstream fish passage facilities for the three dams in the SPP, such as relocating a fish boom at Hydro-Kennebec and increasing spill to up to 50% of inflow during low flow years at Lockwood.[44] Given the dismal

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[42] *Ibid*.

[43] Lusardi, R.A. 2021. Memorandum to Secretary Bose, FERC re: draft Shawmut EA. August 12. P. 1. FERC Accession Number 20210816-5123. Dr. Lusardi is an aquatic research ecologist and applied conservation biologist at the Center for Watershed Sciences and is Adjunct Faculty in the Department of Wildlife, Fish, and Conservation Biology at the University of California, Davis. Dr. Lusardi's memorandum is broadly relevant to this draft SPP and BA.

[44] SPP at pp. 9-1 to 9-2; FERC Accession No. 20210601-5152.

levels of smolt passage that are already occurring at these dams, these measures will not allow Brookfield to reach its passage goals. MDMR has clearly stated that it does not support the use of booms to improve smolt passage. In its comments on Brookfield's application for Water Quality Certification at the Shawmut Project, MDMR stated the following that is also relevant to Brookfield's proposals in the SPP:

> The Licensee proposed to construct a fish guidance boom system that is intended to preclude downstream migrating fish from entrainment in Units 7 and 8. MDMR does not support the Licensee's proposal to use surface guidance booms at the Shawmut Project and finds them to be inadequate to protect the GOM DPS population of Atlantic Salmon and the other diadromous species in the Kennebec River. Data provided by the Licensee in the [SPP, Table 5-1] demonstrates that the guidance booms used at the Lockwood, Hydro-Kennebec, and Weston Projects do not guide 14.3-30.6% of the migrating smolts away from the turbines. Data provided by the Licensee [Shawmut Final License Application, Table 4-22] shows that 32.7% of the downstream migrating smolts were entrained into the turbines at the Shawmut Project. The instantaneous survival was 7% lower when fish went through the turbines compared to spill routes at Shawmut and that grossly underestimates the sublethal effects, including injury and disorientation that would result in higher mortality in the estuary. Studies at the Ellsworth dam on the Union River assessing injury to salmon showed that 22-30% of fish that went through the turbines had injuries compared to 3.8% that went through spill routes, demonstrating that impact quantitatively. The 2015 *Evaluation of Downstream Passage for Adult and Juvenile River Herring* demonstrated that 53 percent of the study fish went through the Lockwood turbines, rather than being guided by the boom to the downstream bypass, and survival was lowest for those fish passing Lockwood via the units (i.e., 77.4% – 81.7% survival). This would indicate that performance standards would not likely be met for these species with the proposed plan…
>
> In addition, MDMR has consulted with the USFWS regarding floating guidance booms and concurs with their comments that are provided below.
>
>> The Service does not know of any studies that have assessed how effective floating guidance booms are at protecting eels as they attempt to migrate downstream past a hydroelectric project. However, we do know that eels are a bottom-oriented species (Brown et al. 2009) and therefore a floating guidance boom with partial depth panels would not be fully protective. As stated in our 2019 Fish Passage Engineering Design Criteria manual, "A floating guidance system for downstream fish passage is constructed as a

> series of partial depth panels or screens anchored across a river channel, reservoir, or power canal. These structures are designed for pelagic fish which commonly approach the guidance system near the upper levels of the water column. While full-depth guidance systems are strongly preferred, partial-depth guidance systems may be acceptable at some sites (e.g., for protection of salmonids, but not eels)." Booms have not been implemented as a protective measure for eels or alosines anywhere else in our region, which spans fourteen states, unless they are installed with other protective measures that are suitable to ensure the safe, timely, and effective downstream passage of our trust species (e.g., inclined bar screens, angled bar racks, etc.). Therefore, the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects, as part of the current SPP process, are protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines.[45]

iii. Best available information and scientific literature do not support attainability of these downstream passage standards.

A meta-analysis of downstream passage studies at hydropower dams in temperate regions revealed extensive fish injury as well as immediate and delayed mortality (Alegra et al., 2020). Smolt mortality is commonly reported to be substantially heightened at dams compared to free-flowing river stretches (Calles and Greenberg, 2009; Norrgård et al., 2013; Stich et al., 2015(17); Nyqvist et al., 2017(2); Alegra et al.; 2020). Direct mortality at dams is also frequently underestimated, as dead smolts are difficult to catch and can be carried downstream by drift or scavengers (Keefer et al., 2012; Havn et al., 2013).

[45] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project, State Water Quality Certification. July 17. pp. 8-9. This document is attached to these Comments.

Stich et al. (2014) reported remarkably high smolt survival of 91% at Milford Dam. However, Milford Dam has Kaplan runners rather than the Francis runners that make up the majority (16 of 21) of turbines at the four dams on the Lower Kennebec. Weston has four Francis turbines (SPP, P. 3-5), Shawmut has six Francis Turbines[46], and Lockwood has six Francis turbines (SPP, P. 3-1). Kaplan turbines are reported in the literature to be significantly less harmful to passing fish (Calles and Greenberg, 2009; Alegra et al., 2020). Therefore, comparisons between the downstream passage rates at the Milford Dam and what is proposed for the lower Kennebec dams are not meaningful and, in fact, inflate Brookfield's claims for future passage success at these dams.

Similarly, smaller trash racks and priority operation of generators proposed by Brookfield would not effectively protect downstream migrating smolts. Current priority operation of generators has not achieved proposed passage standards for smolts, and the proposed trash racks would not exclude smolt from entrainment.

The SPP also fails to adequately evaluate the overall impacts of hydropower operations and resulting delayed mortality on fish. Rapid pressure changes and high probabilities of striking through turbines and high concentrations of dissolved gas below spillways significantly reduce fitness and increase fish vulnerability to predation by impairing swimming and sensory functions necessary to detect and avoid predators (Johnson et al., 2005; Ferguson et al., 2006; Norgarrd et al., 2012). Indirect mortality is not accounted for in the scope of most passage studies, but most recognize it as a basic caveat to their research (Budy et al., 2002; Ferguson et al., 2006; Norgarrd et al., 2012; Stich et al. 2014; Stich et al,. 2015; Alegra et al., 2020).

[46] Brookfield. 2021. INTERIM SPECIES PROTECTION PLAN BIOLOGICAL ASSESSMENT FOR ATLANTIC SALMON FOR THE SHAWMUT PROJECT ON THE KENNEBEC RIVER, MAINE . P. 2-3. FERC Accession Number 20210601-5149.

Alegra et al. (2020) found 81% of data sets that evaluated fish injury at dams reported higher likelihood of injury than controls, 63% of which were significant. Stich et al. 2015 attributed a 6-7% reduction in estuarine smolt survival for each dam passed along their downstream migration. They reported greater indirect dam-related estuarine mortality than direct passage mortality reported at dams on the Penobscot River. Schaller et al. (2014) related the marine mortality of 76% of out-migrating smolts that had survived passage in the Columbia River Power System to their outmigration experience, and positively related delayed mortality to the number of powerhouse passages. Ferguson et al (2006) demonstrated delayed mortality by comparing survival of balloon-tagged and radio-tagged smolts at various distances downstream dams. They attributed 46-70% of total estimated mortality in radio-tagged fish to delayed mortality.

In addition to threats imposed by powerhouse passage, smolts are vulnerable to delays at dams. Successful migration can be critically dependent on the synchronization of numerous confounding factors (McCormick et al., 1998; National Research Council, 2004). Successful smoltification is physically, behaviorally, and environmentally constrained in time. Delays can occur approaching dams due to the transition from passive to active swimming at the impoundment, thermal stress, and difficulty finding confined passage entrances. They reduce fitness and survival through increased exposure to predation and parasites, reduced feeding opportunities, and desmoltification (Mccormick et al., 1998; Keefer et al., 2012).

Even where direct survival has been improved through technological enhancements, impacted stocks continue to decline. Several reports evaluating salmon population viability in the presence of dams recommend that breaching lower dams was the most likely management option to achieve recovery (National Research Council, 2004; Budy et al., 2002; Lawrence et al., 2016).

Brookfield's SPP fails to acknowledge any of this.

iv. Brookfield's SPP contains no performance standards for kelts and completely ignores the importance of repeat spawners in salmon restoration.

The SPP contains no passage standards for Atlantic salmon kelts. Best available information and scientific literature emphasizes the unique importance of repeat spawners, and the difficulty in passing kelts. This is a critical issue for salmon recovery that, under the ESA, cannot be ignored.

Standards for kelts need to be considered and prioritized in order to promote recovery; without this consideration the SPP is inadequate and will likely fail. Research indicates that downstream-migrating adult salmon follow bulk flows (Coutant and Whitney, 2000). However, even with fishways and high flow through spillways, many kelts have been observed passing through turbines, resulting in low downstream passage survival (Calles and Greenberg 2009; Nyqvist et al., 2017(1). Survival through multiple dams compared to that in free-flowing rivers is particularly dismal (Coutant and Whitney, 2000; Wertheimer and Evans, 2005; Holbrook et al., 2009; Norrgård et al., 2013; Nyqvist et al., 2016). The positive contributions kelts were found to make towards population persistence diminished with the presence of multiple dams (Lawrence et al., 2016). Consideration of passage effectiveness rates for kelts is therefore an imperative component of a successful recovery strategy and SPP.

Atlantic salmon are iteroparous and have been documented spawning as much as 6 or 7 times in some populations (Reid and Chaput, 2012; Chaput et al., 2016). Repeat spawners have been shown to comprise as much as 40 percent of returning adults in a given year in some rivers, though the scientific literature indicates that the range within salmon populations is typically from 0 to 26 percent each year (Reid and Chaput, 2012; Maynard et al., 2018; Fleming and Reynolds, 2004).

Repeat spawners are a particularly critical factor necessary for the recovery of Atlantic salmon populations because their populations are small and recovering (Nyqvist et al., 2016; Bordeleau et al., 2020), as is especially the case for the GOM DPS. Improved kelt survival will increase the number of repeat spawners and provide substantial benefits to the population, including increased absolute and relative fecundity, increased egg survival, increased number of year classes present, increased effective population size, and increased probability of population persistence (Fleming, 1996; Halttunen, 2011; Reid and Chaput, 2012; Lawrence et al., 2016; Baktoft et al., 2020).

The number of females, and thus the number of eggs deposited in a spawning year, is a key limiting factor for production in Atlantic salmon populations (Halttunen, 2011). Since repeat spawners tend to be female, their presence or absence can have outsized impacts on a population (Halttunen, 2011; Niemelä et al. 2006). The fecundity of female Atlantic salmon is positively related to body size and age, as well as body condition and experience (Heinimaa and Heinimaa, 2004; Burton et al., 2013; Hanson et al., 2019). Repeat spawning female salmon, which would generally be both larger and older than maiden females, will produce more eggs and have a greater proportional contribution to a given year class. Maynard et al. (2018) reported that a review of salmon egg production on the Connecticut, Merrimack, and Sheepscot Rivers from the 1980s to 2011 found that repeat spawners produced between 2,300 and 3,100 more eggs than maiden spawners. Halttunen (2011) found that an average of 20 percent of the female salmon returning to the River Alta in Norway were repeat spawners and that they contributed 27 percent (ranging from 2 percent to 59 percent) of egg deposition on average. On the Miramichi River in New Brunswick, Canada, repeat spawners have comprised between 6 percent and 21 percent of the total returns of all age groups (Chaput et al., 2016) and have contributed more than 40 percent of total egg deposition in a year (Halttunen, 2011).

Variation in the timing of spawning among year-classes diffuses the adverse effects of environmental variability on spawning success and promotes genetic diversity within populations (Saunders and Schom, 1985; Moore et al., 2014). The presence of 1-sea winter (vast majority male), 2 sea-winter, and 3+ sea winter adults in a spawning population, along with consecutive and alternating repeat spawners (vast majority female), and precocious parr (all male) create a diverse, complex, and resilient population that will be able to persist over time and be more resilient to negative anthropogenic factors, stochastic events, and a changing climate and marine environment. But, these adults all need to be able to access prime spawning and rearing habitats. And the promotion of more abundant repeat spawners via improved kelt survival will positively influence the probability of population persistence (Lawrence et al., 2016). On the other hand, the loss of just a few individual repeat spawners through passage-related mortalities each season has a qualitatively greater impact on the ability of the species to avoid extinction.

Declining numbers of repeat spawners have been widely reported (Hubley et al., 2008, Nyqvist et al., 2016; Maynard et al., 2018) and associated with overharvesting and hydropower projects (Wertheimer and Evans, 2005; Keefer et al., 2008). Average proportions of repeat spawners in the southern North American range of Atlantic salmon have decreased significantly from 4.1 to 2.7% (Bordeleau et al., 2020). Though many northern and mid-latitude populations have exhibited a relative increase in repeat spawners with reductions in fishing pressure, declines seen in the southern range have been attributed to anthropogenic threats such as hydropower projects and reliance on hatchery reared fish (Maynard et al., 2018). Hydropower projects elevate mortality of post-spawners during downstream migration through injuries and delays (Holbrook, 2009; Östergren and Rivinoja, 2008; Ferguson, 2006; Scruton et al, 2007; Kraabøl et al., 2009). Chaput and Jones (2006) highlighted the effects of hydropower projects on repeat spawners by revealing a 4.1% reduction in their prevalence between two proximate populations in the Saint John River above and below the Mactaquac Dam. Size-dependent selection against larger fish reported at passage facilities on the Penobscot and Saint John rivers may limit the persistence of repeat spawners and must be closely examined before building new passage facilities to minimize post-spawning mortality (Maynard et al., 2017; Bordeleau et al., 2020). Furthermore, delays at dams can lead to starvation, accumulated stress, increased predation and loss of marine adaptations, lowering the chances of surviving to feeding grounds (Nyqvist et al., 2016).

Repeat spawners have almost been entirely eliminated from the GOM DPS. On the Penobscot River, repeat spawners comprised 1.7% of the run in the 1980s, but only 0.6% in the early 2010s (Maynard et al., 2018). It is important to remember that the 1.7% number from the 1980s was likely significantly lower than natural return rates for repeat spawners prior to more than 250 years of anthropogenic impacts that reduced the total run size from more than 100,000 individuals to a few thousand. On the Kennebec River, the Lockwood fish lift has only passed one repeat spawning salmon in 16 years of operation. The event was so extraordinary that the salmon, called Charlie, was headline news (Holyoke, 2019).

Recent data from researchers at the University of Maine support all of the above concerns about negative dam impacts on critically important repeat spawners and specifically show that a four-dam system would result in a loss of more than 50% of pre-spawn and post-spawn fish. In an email to the Kennebec Coalition describing work with graduate student Sarah Rubenstein, University of Maine Professor Joseph Zydlewski stated:

> 1) ATS [Atlantic salmon] face poor passage at some dams (e.g. Lockwood)
>
> 2) If passing, ATS often face long delays, usually weeks in length - sometimes months
>
> 3) Because of the high and rising downstream temperatures in lower rivers in the summer during river entry and migration, there is increased metabolic cost and this is directly related to depletion of limited and fixed energy stores.
>
> 4) Our bioenergetic model suggests that these delays significantly lower the probability of spawning success (depletion of energy stores prior to spawning likely leading to mortalities) and biologically significant declines in the probability of repeat spawning (due to energy depletion and likely mortality). For a four dam system, this loss is estimated to be greater than 50% loss for pre-spawn and post-spawn fish. These are likely conservative estimates as delays at dams are associated with increases in searching behavior, and activity means more energy demand.
>
> 5) Extensive literature suggests that older, larger, repeat spawning fish are critical for population resilience, and hence recovery (see attached).[47] In the Penobscot River (see Maynard et al., 2018) repeat

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[47] Dr. Zydlewski is referring to the following paper attached to his email cited below: Hixon, M.A., Johnson, D.W. and Sogard, S.M., 2014. BOFFFFs: on the importance of conserving old-growth age structure in fishery populations. *ICES Journal of Marine Science*, *71*(8), pp.2171-2185.

> spawning is less than 1%, far less than occurs in un-dammed ATS rivers. This fact provided direct evidence that dams are associated with and likely causal to low survival (increased mortality) of post spawn salmon and underscored the demographic fragility resulting from this persistent fixed source of mortality.[48]

The SPP's failure to even analyze the environmental consequences of downstream passage for kelts, and its failure to set passage performance standards to address the unique importance of kelt passage and repeat spawning should result in a jeopardy finding.

D. The SPP ignores mortality associated with maintenance activities at the dams.

i. Injury and mortality at the Lockwood Project indicate that this is a serious problem; multiplied at four dams, it would be far worse.

At Lockwood, false attraction to the bypass channel, combined with annual fluctuations in station discharge caused by flashboard installation, require a "fish rescue" every time flashboards are installed. According to MDMR, in 2021 this event resulted in at least three adult Atlantic salmon becoming stranded in isolated pools in the Lockwood bypass channel. One of these salmon captured and trucked upstream suffered extensive injuries, including "scraped up body dorsally, scraped up sides (both left and right), an abrasion ventrally, a bruise on its left side, a lamprey wound scar on its right side, a split dorsal fin, a split caudal fin and a bruised snout."[49] At least two other adult Atlantic

[48] Zydlewski, Joseph. 2021. Email to Landis Hudson, Maine Rivers Executive Director. Re: "Rubenstein Defense This Friday August 6." Received August 7. This document is attached to these Comments.

[49] MDMR (Jennifer Noll). June 17, 2021. Field Summary of Atlantic Salmon Stranding Rescue at Lockwood Dam. (This report was included as Attachment 1 to a filing about the event by Trout Unlimited submitted on July 1, 2021: FERC Accession No. 20210701-5242.)

salmon, one with "significant scars located dorsally on its body"[50] were also trapped during this event, but could not be captured and transported. In 2021, three endangered Atlantic salmon (compared to 15 that had been trapped and trucked from the Lockwood Dam fish lift as of August 9, 2021[51]) were subjected to this stress—two with significant injuries. That is 17% of total salmon returns to the Kennebec—at just a single dam. The future suggested by this SPP would include similar inefficiencies at four dams, before endangered salmon even reach spawning habitat in the Sandy River. The SPP does not acknowledge these inefficiencies at all.

E. Brookfield's adaptive management proposals are inadequate.

Brookfield repeatedly says that if it does not meet passage goals it will use "adaptive management" to address them.[52] However, throughout the SPP, Brookfield proposes no concrete measures it would take in the aftermath of fish passage failure. The Kennebec Coalition has watched Brookfield's "adaptive management" since it entered Maine, and we have witnessed its complete failure. Brookfield has "adaptively managed" the failed Lockwood fishway since 2013. MDMR describes Brookfield's adaptive management this way:

> Fish passage failures at the Lockwood Project provide a cautionary tale as unexpectedly poor performance has left hundreds of returning endangered Atlantic salmon to die or spawn in subpar habitats below the project and likely

[50] Ibid.

[51] Maine Department of Marine Resources "Recent Trap Counts for Fish Returns to Maine by River," accessed at https://www.maine.gov/dmr/science-research/searun/programs/trapcounts.html on 8/11/2021.

[52] See, e.g., SPP at p. 7-30; FERC Accession No. 20210601-5152.

tens or hundreds of thousands of American shad and other species to be blocked from historic habitats annually.[53]

To the extent that federal agencies allow Brookfield to rely on fishways to meet the requirements of an SPP, they must spell out specific and enforceable adaptive management steps. For example, if a single upstream fishway proves ineffective after two years of testing, the agencies should require Brookfield to construct a second fishway. If the first and second fishways prove ineffective, the agencies should require a third fishway, until fish pass at required levels. Another measure – in light of the lack of current best available data to support Brookfield's plans for engineered fishways as a suitable passage solution in the first place – would be for the Commission to hold in abeyance an order for license reopening and order for plans for decommissioning, should passage facilities fail (as they are expected to do, under current available data). The Kennebec Coalition continues to believe that removal of all four of Brookfield's Lower Kennebec dams is necessary, and feasible as the comparatively least expensive approach. But if Brookfield moves forward with plans for fishway construction, agencies cannot allow the company to tweak failing fishways forever, which is clearly Brookfield's preferred mode of operation. Sea-run fish will always lose in this scenario.

[53] 2020. MDMR. MDMR Response to the Ready for Environmental Analysis (REA) Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions for the Shawmut Project (P-2322-069). August 28, 2020. P.3. Accessible at https://1drv.ms/u/s!AkLlihAdyxqVklBuZIG6A5l9pnd8?e=sWgbBm.

F. Brookfield's SPP contains almost nothing on restoration of the other sea-run fish species without which salmon restoration is impossible.

i. The SPP fails to acknowledge the importance of Maine's management goals for sea-run species in the Kennebec.

Brookfield's SPP lacks any evaluation of passage standards for species other than salmon. It dismisses the State's Minimum Species Goals for the Kennebec River, which are:

> The minimum goal for **Atlantic Salmon** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 500 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for Endangered Species Act (ESA) down-listing and a minimum annual return of 2,000 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for reclassification based on the NOAA and USFWS Recovery Plan (2019). To reach spawning/rearing habitat in the Sandy River, Carrabassett River, and mainstem Kennebec River, all returning adults must annually pass upstream at the Lockwood, Hydro Kennebec, Shawmut, and Weston project dams.
>
> The minimum goal for **American Shad** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 1,018,000[1] wild adults to the mouth of the Kennebec River; a minimum annual return of 509,000 adults above Augusta; a minimum of 303,500 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 260,500 adults annually passing upstream at the Shawmut Project dam; and a minimum of 156,600 adults annually passing upstream at the Weston Project dam.
>
> The minimum goal for **Blueback Herring** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 6,000,000 wild adults to the mouth of the Kennebec River; a minimum annual return of 3,000,000 adults above Augusta; a minimum of 1,788,000 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 1,535,000 adults annually passing upstream at the Shawmut Project dam; and a minimum of 922,400 adults passing upstream at the Weston Project dam.
>
> The minimum goal for **Alewife** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 5,785,000 adults above Augusta; a minimum of 608,200 adults annually passing

> at the Lockwood, Hydro Kennebec, and Shawmut project dams; and a minimum of 473,500 adults annually passing upstream at the Weston Project dam.
>
> The minimum goal for **Sea Lamprey and American Eel** is to provide safe, timely, and effective upstream and downstream passage throughout the historically accessible habitat of these two species.[54]

The SPP's failure to develop passage standards for species other than Atlantic salmon is not just clearly inconsistent with Maine's management goals but also undercuts them. NMFS shares the MDMR's goals, stating in its comments on the Shawmut license application that:

> [t]he Kennebec River watershed once produced large runs of Atlantic salmon, American shad, blueback herring and alewife, as well as other sea-run fish including shortnose and Atlantic sturgeon (MSPO, 1993). Diadromous fish once contributed to substantial commercial, recreational, and subsistence harvests (MSPO, 1993) that were economically important to coastal communities. Anadromous fish production within the Kennebec River experienced dramatic declines throughout the past 150 years. Multiple plans since the 1980s, including the Kennebec River Resource Management Plan (1993), KHDG Settlement Accord (1998) and Atlantic salmon recovery plan (2019), highlight the importance of fish passage and habitat restoration as critical to supporting a restored anadromous fishery. Significant spawning, rearing, and migratory habitat exists above the Shawmut Project. Existing dams prevent access to those historical habitats.[55]

[54] MDMR. 2021. Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322). Hydroelectric Project, State Water Quality Certification. July 17. p. 2. Accessible at https://www.maine.gov/dep/ftp/HYDRO/WaterQualityCertifications/Shawmut/agency-comments/DMR%20Comments%20to%20DEP%20WQC%20Shawmut_July.pdf. Also attached to these Comments.

[55] 2020. NMFS. Comments, Recommendations, Preliminary terms and Conditions, and Preliminary Fishway Prescriptions for the Shawmut Hydroelectric Project (FERC No. 2322). Pp. 43-44. August 28. FERC Accession Number 20200828-5176.

ii. The SPP's lack of standards for the full suite of sea-run species in the Kennebec guarantee's the failure of salmon restoration efforts for the river.

In the June 19, 2009 NMFS and USFWS determination of endangered status for the GOM DPS of Atlantic salmon, the agencies found:

> Of particular concern for Atlantic salmon recovery efforts within the range of the GOM DPS is the dramatic decline observed in the diadromous fish community. At historic abundance levels, Fay et al. (2006) and Saunders et al. (2006) hypothesized that several of the co-evolved diadromous fishes may have provided substantial benefits to Atlantic salmon through at least four mechanisms: serving as an alternative prey source for salmon predators; serving as prey for salmon directly; depositing marine-derived nutrients in freshwater; and increasing substrate diversity of rivers.[56]

Restoration of the suite of sea-run species with which Atlantic salmon co-evolved is necessary to restore Atlantic salmon. These species provide a prey buffer for salmon, particularly for salmon smolts migrating downstream at the same time that alewife and blueback herring are at the peak of their upstream migration. Without this buffer, avian and fish predators will focus their attention on salmon smolts. With large numbers of alewife and blueback herring migrating upstream during the smolt migration, predation on less numerous and smaller salmon smolts will be much reduced. Hence, without this prey buffer, salmon restoration is likely impossible.[57]

The Final Recovery Plan for the GOM DPS of Atlantic salmon makes clear both that dams were a primary factor in in the decimation and near extirpation of Atlantic

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[56] 74 Fed. Reg. 29,344-01 at 29,374-75 (Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon) (June 19, 2009).

[57] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*). Hadley, Massachusetts. January 2019. 74 pp. at P11 (hereafter "2019 Final Recovery Plan"). *See also* 74 Fed. Reg. 29,344-01 at 29,374-75 (NMFS Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon) (June 19, 2009).

salmon runs and that the continued low abundance of co-evolved diadromous fish is a "secondary stressor" that contributes to reduced survival of Atlantic salmon:

> Damming rivers, thus preventing migration to spawning grounds, was a major factor in the decline of Atlantic salmon and much of the co-evolved suite of diadromous fish (e.g., alewife and blueback herring). Many co-evolved diadromous species have experienced dramatic declines throughout their ranges and current abundance indices are fractions of historical levels. The dramatic decline in diadromous species has negative impacts on Atlantic salmon populations, including through depletion of an alternative food source for predators of salmon, reductions in food available for juvenile and adult salmon, nutrient cycling, and habitat conditioning. These impacts may be contributing to decreased survival in lower river and estuarine areas.[58]

Clearly an SPP that ignores the suite of species that co-evolved with Atlantic salmon offers no hope of recovering this species.

But in addition, the licenses of the Projects also require passage of the full suite of sea-run species – for the duration of their licenses to 2036 – and this obligation cannot be ignored as a license term in and of itself. The State's restoration goals for recovery of the suite of sea-run species were made license terms when the Commission approved the KHDG Agreement and incorporated its fish restoration goals and fish passage provisions into the licenses of the four projects – Lockwood, Hydro-Kennebec, Shawmut, and Weston.[59] In turn, each extant water quality certification from the State, for each Project, under section 401 of the Clean Water Act, 33 U.S.C. § 1341, relies upon meeting fundamental performance standards. Each Project must pass *all* species to meet the sea-run restoration goals generally, to minimize each Project's undue adverse impact to the

[58] 2019 Final Recovery Plan at p. 11.

[59] *Edwards Manufacturing Co., Inc., and City of Augusta, Maine*, 84 FERC ¶ 61,227 (1998) (incorporating May 27, 1998 Lower Kennebec River Comprehensive Settlement Accord (KHDG Agreement)).

environment and critical habitat, and to meet the challenge of recovery of Atlantic salmon.

G. Brookfield misrepresents the water quality attainment status of its impoundments.

Brookfield falsely claims that all four of the Lower Kennebec dams meet state water quality standards. In its BA, Brookfield falsely states: "Water quality at all four Projects is good both upstream and downstream of the dams, and Project waters at all four Projects meet state water quality standards."[60]

However, according to DEP's most recent Integrated Water Quality Monitoring Report Appendices, the Shawmut impoundment is listed under "Category 3: Rivers and Streams with Insufficient Data or Information to Determine if Designated Uses are Attained (One or More Uses may be Impaired)".[61] The Appendices further state, in reference to the segments of the Kennebec above and below the Shawmut Project: "Category 3 for potential aquatic life use impairment; insufficient data to delist: macroinvertebrate community attained Class C in 2004 but did not attain in 2002."[62]

H. Brookfield's BA repeatedly and incorrectly refers to viable salmon spawning and rearing habitat below the Lockwood Dam.

Brookfield attempts to divert attention away from the importance of achieving safe, timely and effective fish passage to the Sandy River by making inaccurate claims regarding the value and significance of salmon habitat in other parts of the watershed,

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[60] BA at p. 5-1; FERC Accession No. 20210601-5152.

[61] Maine DEP. 2018. 2016 Integrated Water Quality Monitoring Report. Appendices. P. 60. Accessed at https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

[62] Maine DEP. 2018. 2016 Integrated Water Quality Monitoring Report. Appendices. P. 60. Accessed at https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

including inaccurate claims about mainstem habitat below the Lockwood Dam, as well as habitat in tributaries like Bond Brook and Togus Stream.

The Inter-Agency Merrymeeting Bay Coordinating Committee lists the Kennebec Watershed, and specifically the Sandy River and upper Kennebec, as:

> [T]he top priority for recovery work because it has the most habitat in the SHRU, including the highest quality habitat and thermally optimal habitat. The four mainstem dams on the lower Kennebec River currently block free-swim access to high-quality habitat in the upper watershed, including the Sandy River. The Kennebec watershed upstream of the lowermost dam, Lockwood, contains a majority of quality salmon habitat within the MMB SHRU and includes some of the most diverse and abundant Atlantic salmon habitat in the United States.[63]

MDMR focuses their salmon egg planting program in the Sandy River, above all four of Brookfield's dams, and MDMR releases returning adult salmon into this habitat *precisely* because the upper Sandy contains large quantities of some of the highest quality spawning and rearing in the Kennebec River, the Merrymeeting Bay SHRU, and, in fact, within the entire geographic area that supports the endangered GOM DPS of Atlantic salmon.

The lower mainstem Kennebec River was ranked by NMFS as having "the highest biological value to the Merrymeeting Bay SHRU because *it provides the central migration conduit for much of the currently occupied habitat found in the Sandy River*."[64] The high valuation is only because the mainstem river is the *corridor* for migrating

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[63] Maine DMR, NMFS, and USFWS. 2020. Merrymeeting Bay Atlantic Salmon Habitat Recovery Unit Five-year Work Plan (2020-2025). Draft, approved by Atlantic Salmon CMS Board, June 2021, final version not yet generated. P. 2.

[64] NOAA Fisheries. 2009. Biological Valuation of Atlantic Salmon Habitat within the Gulf of Maine Distinct Population Segment. P. 79. Available from: https://atlanticsalmonrestoration.org/resources/documents/atlantic-salmon-recovery-plan-2015/appendix-to-recovery-plan/critical-habitat/biological-valuation-of-atlantic-salmon-habitat-2009/index_html.

salmon smolts and adults, providing access to the high elevation critical habitat for spawning and rearing, not because the lower mainstem itself contains adequate amounts of habitat with those values.

The lower mainstem Kennebec does not have high value for spawning and rearing, and Brookfield's BA is highly misleading in this respect. The habitat in the lower Kennebec simply lacks the critical habitat features or environmental or physical features needed to support successful spawning and rearing of Atlantic salmon. Maine DMR salmon biologist Paul Christman describes the 82 miles of the mainstem Kennebec below the Weston Dam in Skowhegan as not having suitable juvenile rearing habitat: "Some portions of it may meet some of the physical characteristics of habitat during portions of the year however given the numerous issues like the predatory fish assemblage, lack of thermal refuge and poor water quality (Biological Valuation 2009 page 78) make this reach unlivable for vulnerable juveniles."[65]

There are small pockets of suitable habitat in tributaries of the lower Kennebec, most notably Bond Brook and Togus Stream. These are small subwatersheds, draining 21.35 and 22.37 square miles, respectively, and certainly not "major tributaries" as described in the BA.[66] Combined, Bond Brook and Togus Stream have only 565 units of habitat and both of these minor tributaries have a number of issues that decrease the quality of their salmon habitat. Togus Stream drains from Togus Pond, a warmwater pond whose fish community today is dominated by smallmouth bass, largemouth bass, and chain pickerel. Togus Stream flows through a suburban area with multiple

[65] Christman, Paul. 2021. Email to John Burrows, Executive Director of U.S. Operations, Atlantic Salmon Federation. "Kennebec Habitat." Received August 28. This document is attached to these Comments.

[66] BA page 1-13; FERC Accession No. 20210601-5152.

anthropogenic impacts to habitat. Bond Brook has its headwaters in suburbs west and north of the City of Augusta, and its lower tributaries and mainstem flow through a heavily developed, urban environment before entering the Kennebec. Portions of the Bond Brook watershed are classified as an Urban Impaired Stream Watershed.[67]

The BA further states that "… modelling and survey efforts have identified suitable spawning habitat in the mainstem river below the Lockwood Project, some of which is within 300 meters of the Project (Table 1-2) (NMFS 2013). The 3,131 habitat units estimated to be downstream of Lockwood are currently accessible to pre-spawn adults and could be used for spawning and rearing of juvenile salmon."[68] Yet Maine DMR salmon biologist Paul Christman describes the physical habitat survey on the mainstem Kennebec River as follows:

> This survey was conducted in anticipation of the construction of the Lockwood Fish Lift and the initiation of salmon restoration. The primary goal of the survey was to characterize the reach of river below Lockwood to head of tide for holding pool and potential sites for angling opportunities. The survey technique measured numerous physical characteristics such as depth, widths and substrate. While some of this information can be used to physically classify sections as juvenile rearing and spawning, these surveys do not take into account any qualitative information and were never intended for this purpose."[69]

The BA clearly gives the false impression that salmon recovery—or even persistence—could be supported by production in mainstem habitat below the Lockwood Dam or in the small and heavily impacted tributaries that enter the Kennebec near and below the

[67] Maine DEP. 2018. 2016 Integrated Water Quality Monitoring Report. Appendices. P. 126. Accessed at https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

[68] BA P. 1-12; FERC Accession No. 20210601-5152.

[69] Christman, Paul. 2021. Email to John Burrows, Executive Director of U.S. Operations, Atlantic Salmon Federation. "Kennebec Habitat." Received August 28. This document is attached to these Comments.

head of tide. The reality is that, like most of the large salmon rivers in the United States and Atlantic Canada, the bulk of Atlantic salmon habitat has always been in its high elevation, high gradient headwater tributaries. NOAA's Biological Valuation of Atlantic Salmon Habitat within the Gulf of Maine Distinct Population Segment (2009) states that: "In the Kennebec basin, historically important tributaries to Atlantic salmon included the Dead River, Carrabassett River and Sandy River (Atkins and Foster, 1867), which are generally characterized as high elevation tributaries that are dominated by rapids, riffles and the occasional falls with a substrate composed of boulders, cobble, and gravel."[70] Of those historically important tributaries, only the Sandy River is within currently designated Critical Habitat for endangered Atlantic salmon.[71]

NOAA's *Atlantic Salmon SHRU Specific Implementation Strategy* describes the importance of the Kennebec River watershed to Atlantic salmon recovery, stating that the Kennebec "contains the most abundant, most suitable habitats for Atlantic salmon in the GOM DPS" and that the Kennebec "may have greater resilience to climate change because of its high gradient systems and cool water influences.[72] Rivers like the Kennebec, with large quantities of high quality habitats, that are able to support large salmon populations are "more resilient to anthropogenic and environmental stressors then smaller rivers."[73] Nearly all of the Kennebec's high quality habitat is located in the upper

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[70] NOAA Fisheries. 2009. Biological Valuation of Atlantic Salmon Habitat within the Gulf of Maine Distinct Population Segment. P. 72. Available from: https://atlanticsalmonrestoration.org/resources/documents/atlantic-salmon-recovery-plan-2015/appendix-to-recovery-plan/critical-habitat/biological-valuation-of-atlantic-salmon-habitat-2009/index_html.

[71] 74 Fed. Reg. 29,300 (NMFS, Designation of Critical Habitat for Atlantic Salmon (Salmo salar) Gulf of Maine Distinct Population Segment) (June 19, 2009).

[72] NOAA Fisheries. 2016. SHRU Specific Recovery Implementation Strategy (Draft). P. 20-21.

[73] *Id*.

half of the watershed, above these four Brookfield Projects. The upper Kennebec not only contains the majority of quality salmon habitat in the Merrymeeting Bay SHRU, but it also "includes some of the most diverse and abundant Atlantic salmon habitat in the United States."[74] The Sandy River, which is the only part of the upper Kennebec currently occupied by Atlantic salmon, typifies this and is one of the most important areas for Atlantic salmon recovery. With more than 43,000 units of habitat, the Sandy River HUC 10 watershed has more Atlantic salmon habitat than any of the other 27 HUC 10 watersheds that were historically accessible to Atlantic salmon within the Merrymeeting Bay SHRU (HUC stands for Hydrologic Unit Code and is the national classification system for watershed by size).[75] The Sandy River has "the greatest biological value for spawning and rearing habitat within the occupied range of the Merrymeeting Bay SHRU."[76]

The Sandy River's salmon habitat is diverse and well-connected – the entire 70-mile mainstem from Small's Falls to the confluence with the Kennebec is free-flowing – and is situated in a largely undeveloped and well-forested area of the western Maine mountains. The Sandy is characterized by extensive boulder, cobble, and gravel substrate; long, medium to high gradient riffles; and an alluvial flood plain. These features make the Sandy different than many of the other rivers within the GOM DPS and create unique rearing opportunities for Atlantic salmon, which will lead to increased

[74] Maine DMR, NMFS, and USFWS. 2020. Merrymeeting Bay Atlantic Salmon Habitat Recovery Unit Five-year Work Plan (2020-2025). Draft, approved by Atlantic Salmon CMS Board, June 2021, final version not yet generated. P. 3.

[75] NOAA Fisheries. 2009. Biological Valuation of Atlantic Salmon Habitat within the Gulf of Maine Distinct Population Segment. P. 82-83.

[76] Ibid, 79.

diversity and lowered risk of extirpation, if the species can actually get to these habitats.[77] The upper Sandy and its tributaries are also located in a high elevation area that remains cool throughout the year, providing optimal water temperatures for juvenile salmon growth and survival. The array of diverse habitats found in the Sandy are critical "for supporting an abundant, diverse and resilient Atlantic salmon population."[78]

II. Conclusion

Even if everything Brookfield proposes in the SPP were to work according to plan, which best available science and information show is not possible, it would still result in unacceptable mortality for Atlantic salmon:

- Brookfield's SPP proposes to kill 11.5% of salmon smolts from the Sandy River—the largest run of smolts within the entire DPS, and the only run that is entirely made up of naturally-reared salmon—on their way to the ocean;
- Brookfield's SPP proposes to prevent 15.1% of the returning adults from passing upstream to spawn;
- Combined, that means that Brookfield's SPP proposes to reduce the Kennebec salmon run by 26.6% *every year*, for the duration of these licenses through 2036.

Even Brookfield's rosy analysis in the SPP should yield a finding of jeopardy to the survival and recovery of Atlantic salmon. The reality, however, is far worse. As the above shows, Brookfield cannot meet any of the standards it proposes for salmon in this SPP. Further, Brookfield's failure to guarantee successful passage for other sea-run species is another nail in the coffin of Kennebec salmon, and in any efforts at fish restoration on the Kennebec.

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[77] NOAA Fisheries. 2016. SHRU Specific Recovery Implementation Strategy (Draft). P. 25.

[78] Ibid, 20.

In the final analysis, Brookfield is facing an insoluble problem. Brookfield's undisputed delays in preparing this SPP and BA are self-evident and reflect how insoluble the problem is. The delay now exceeds by almost two years the expiration of take authorizations at each of the Projects under the ESA on December 31, 2019, and exceeds by over three years this Commission's designation of Brookfield as its non-federal representative under the ESA.[79] It is worth noting that the non-federal designation also was premised upon Brookfield's promise to "file a basin-wide SPP in January 2019, concurrent with the Final License Application submission for the Shawmut Project."[80] The Commission even stated that "[t]his should allow sufficient time to complete the FERC Section 7 consultation process and the BO [Biological Opinion] issuance **prior to the December 2019 expiration**."[81] Brookfield did not meet these promises.

But we believe that the delay is indicative of the heart of the issue: Brookfield does not have a suitable solution to the problem of these hydropower projects' permanently impairing sea-run fish restoration on the Kennebec and never will. That is because there is no feasible solution at all. These Projects and their continued operations are incompatible with the survival and recovery of Atlantic salmon and with fundamental fish passage mandates and restoration goals for the other sea-run species. The project licensees – Brookfield and its predecessors – have had since the Atlantic salmon expanded ESA listing in 2009, and even since the KHDG Agreement of 1998

[79] FERC Accession No. 20180212-5110.

[80] *Id*.

[81] *Id*.

(incorporated into the existing licenses in issue), with even a further extension of these timeframes provided by the Interim SPP periods of 2012 through December 31, 2019.[82] In all this the time, they have been unable to solve the restoration problem on the river by fish passage engineering. That they have failed to do so speaks louder than words: it is a result of the current best available information that there is no viable engineered fish passage solution that will work to solve the problem.

With this fish passage plan, Brookfield is making extraordinary claims for passage performance that are unsupported by current available data, and Brookfield omits passage performance standards for the other species, leaving them completely unaddressed. Extraordinary claims require extraordinary proof. Without extraordinary measures – such as the installation of multiple fish passage facilities at each site (as an example, as proposed by MDMR in relation to the Shawmut Project) – Brookfield's extraordinary promises about fish passage working at each project will inevitably become broken promises, and will be relegated to the experiential heap of failed passages at every other multi-dam system that has ever faced this challenge of passing Atlantic salmon and other sea-run species like American shad. This failure will occur at the expense of an endangered species, resulting in the extirpation of the species from the Kennebec River, and resulting in ESA-defined jeopardy to the survival and recovery of the species. This Commission has the independent obligation to "seek to conserve endangered species and threatened species," and "shall utilize [its] authorities in furtherance of the purposes of [the ESA]." 16 U.S.C. § 1531(c). In addition, significant and effective passage of the

[82] See FERC Accession No. 20180920-3040 (Commission Order at ¶ 3) (discussing requirements for fish passage at each Project, primarily contained in Exhibit B of the May 27, 1998 Lower Kennebec River Comprehensive Settlement Accord ("KHDG Agreement"), and incorporated into each license*)*; *Edwards Manufacturing Co. Inc.*, 84 FERC ¶ 61, 227 (1998).

suite of other co-evolved sea-run species is vital to the conservation of Atlantic salmon, and required to minimize adverse impact to the environment. Such passage standards for other species are also a term of each Project license in issue, and a key condition of the State water quality certifications for each Project in issue under Section 401 of the Clean Water Act.

We respectfully request that the Commission deny the amendment application in issue. We request that the Commission prepare an Environmental Impact Statement under NEPA, in relation to its review of the plans in the pending amendment application (and with respect to the Shawmut relicensing, as we and the resource agencies have previously called for). In that context, the Commission may then evaluate whether continued operations of each project jeopardize the survival and recovery of Atlantic salmon. This may therefore call for the exercise of the Commission's reservation authority to reopen the licenses, to include analysis of the reasonable alternative of plans for decommissioning of the Projects.[83] All of the long, delay-engendering present proceedings on SPP and BA preparation and analysis, combined with the required NEPA

[83] Since 1991, the Commission's reservation of authority to reopen a license is incorporated in all hydropower licenses. See Article 15 of standard form L-3 of the licenses. The Commission's reservation of authority in this respect is also inherent in the license and in Commission practice and protocol. *See Phelps-Dodge Morenci, Inc.*, 94 FERC ¶ 61,202 (Feb. 23, 2001):

> Rather, when the Commission becomes aware of information to suggest that ongoing operation of a project may affect a threatened or endangered species, it is our practice to direct our staff to investigate the situation, in consultation with the licensee, the FWS (or NMFS, as appropriate), and any other interested participants, to determine what effects, if any, may be occurring, and what changes, if any, should be considered to avoid or mitigate those effects.

Id. at 6 and n.40. If, as in this case, no changes are available to "avoid or mitigate" those effects, this Commission must then seriously revisit for each Project the Federal Power Act's vision of giving "equal consideration" to the "protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), . . . and the preservation of other aspects of environmental quality." 16 U.S.C. § 797(e).

"hard and honest look" at environmental consequences (a NEPA analysis that cannot be lightly skipped by the Commission) certainly will satisfy the Commission's standards for a premise of investigation to reopen a license.[84] After SPP, BA, and NEPA analysis of this four-dam system, no further investigation is needed to conclude that engineered fish passage will not meet the present demands of fish restoration on the Kennebec River.

Respectfully submitted, this 25th day of August, 2021,

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[84] *See Hoopa Valley Tribe v. FERC*, 629 F.3d 209 (D.C. Cir. 2010) (while the Commission does not undertake reopener proceedings lightly, it may do so after first investigating what effects, if any, may be occurring and whether there is a need to require changes to address those effects).

CERTIFICATE OF SERVICE

I, Russell B. Pierce, Jr., Esq., hereby certify that on August 25, 2021 a copy of these comments was transmitted by electronic means to each of the persons on the Service list maintained by the Secretary of the Commission.

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Weaver, D.M., S.M. Coghlan, Jr., J. Zydlewski. 2016. Sea lamprey carcasses exert local and variable food web effects in a nutrient-limited Atlantic coastal stream. Can. J. Fish. Aquat. Sci. 73 (11): 1615-1625.

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Landis Hudson
Executive Director, Maine Rivers
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Phone: 207-847-9277
Our mission is to protect, restore and enhance the ecological health of Maine's river systems

On 8/7/21, 9:49 AM, "Joseph Zydlewski" <josephz@maine.edu> wrote:

Landis -

Thanks for the kind words. Yes - PLEASE use this information.

We should have a thesis you can point to in short order - but for now you can point to Rubenstein, Sarah and Zydlewski, Joseph, unpublished data.

This will be submitted for publication by the January, so really in pub form ~ June of next year if all goes well.

The major points

1) ATS face poor passage at some dams (e.g. Lockwood)

2) If passing, ATS often face long delays, usually weeks in length - sometimes months

3) Because of the high and rising downstream temperatures in lower rivers in the summer during river entry and migration, there is increased metabolic cost and this is directly related to depletion of limited and fixed energy stores.

4) Our bioenergetic model suggests that these delays significantly lower the probability of spawning success (depletion of energy stores prior to spawning likely leading to mortalities) and biologically significant declines in the probability of repeat spawning (due to energy depletion and likely mortality). For a four dam system, this loss is estimated to be greater than 50% loss for pre-spawn and post-spawn fish. These are likely conservative estimates as delays at dams are associated with increases in searching behavior, and activity means more energy demand.

5) Extensive literature suggests that older, larger, repeat spawning fish are critical for population resilience , and hence recovery (see attached). In the Penobscot River (see Maynard et al., 2018) repeat spawning is less than 1%, far less than occurs in un-dammed ATS rivers. This fact provided direct evidence that dams are associated with and likely causal to low survival (increased mortality) of post spawn salmon and underscored the demographic fragility resulting from this persistent fixed source of mortality.

Joe Z

Donald H. Pugh, Jr.
10 Old Stage Road
Wendell, MA 01379
Telephone 978 544 7438 Office
413 387 9439 Cell

Work History:

Self Employed

Current projects:

Maryland Power Plant Research Project – relicensing of Conowingo Project (FERC # 405) on the Susquehanna River and post-license studies at Holtwood (FERC # 1881) and York Haven (FERC # 1888) upstream of Conowingo. Principle areas of responsibility include: up- and downstream fish passage, telemetry data analysis, fish biology, habitat-flow analysis, and American eel passage.

Connecticut River Conservancy – relicensing of First light hydroelectric projects on the Connecticut River at Turners Falls (FERC # 1889) and the Northfield Mountain Pumped Storage Station (FERC #2485). Scoping began in 2012. First Light has filed its final license application. Reviewed study plans, study reports, IFIM review, shortnose sturgeon spawning flow needs analysis, and shad telemetry analysis. Participated in settlement talks with company, state and federal agencies, and NGOs.

SWCA, Inc. – Shortnose and Atlantic sturgeon habitat and protection plans for sewer line crossing construction on the Connecticut River, Springfield, Massachusetts.

Geosyntec consultants - Shortnose and Atlantic sturgeon habitat and protection plans for river bank stabilization on the Merrimack River, Haverhill, Massachusetts

Maine Rivers – relicensing of three projects on the Mousam River (FERC # 14856).

Kennebec Coalition – review and data analysis of downstream smolt radio telemetry studies (2012 – 2015) and the upstream fish passage plan at the Shawmut project on the Kennebec River (FERC # 2322).

Member of the Holyoke Cooperative Consultation Team for the Holyoke Hydroelectric Project (FERC #2004). Post-licensing downstream fish passage planning including configuration of the downstream passage protection structure, review of CFD analysis, analysis of telemetry data of American shad, shortnose sturgeon, and American eel during post licensing studies.

Santo Antônio , January 2010 to June 2011

TIRIS PIT tag installation, data analysis, and fish passage consultation for an experimental fish passage flume on the Rio Maderia, Brazil.

American Rivers, April 2010 to November 2011

Represented American Rivers for the relicensing of three projects on the Susquehanna River – Conowingo Dam, Muddy Run Pumped Storage Project and York Haven Dam. Participated in study plan development, reviewed study reports and prepared comment letters, attended meetings with the project owners, the FERC, state and federal agencies, and NGO's. Developed and independent analysis of American shad telemetry data at York Haven and Conowingo.

University of Massachusetts, Amherst MA January 1997 to January 2009

Research Assistant in the Department of Natural Resource Conservation working at the

Silvio Conte Anadromous Research Center – areas of research included the behavior and movement of adult Atlantic salmon in the Westfield River in Massachusetts using radio telemetry, upstream passage of sturgeons and riverine fishes in a spiral fishway, spawning behavior of shortnose sturgeon in an artificial 'stream, and downstream passage of sturgeons at a bar rack and louver system with a low level bypass entrance.

Massachusetts Cooperative Fisheries and Wildlife Research Unit, University of Massachusetts, Amherst MA
March 1991 to January 1997

Project Leader for Anadromous Fish Investigations project. Duties include: hire and supervise technicians staffing the Holyoke, Turners Falls, and Westfield River fish passage facilities; conduct recreational angler creel surveys, Atlantic salmon habitat assessment, and juvenile growth and survival estimates; supervise stocking of Atlantic salmon fry for the Connecticut River basin in Massachusetts; coordinate Unit operations with utility companies and state and federal agencies; and prepare budgets and reports.

Education:

Undergraduate

Trinity College
Hartford, CT 1967-71, B.A.
Major: History
Specialty: American History

Continuing Ed.

Greenfield Community College
Photography I, II & III, Fall 1980-81
Engineering Drawing, Fall 1978
Drafting for Engineers, Spring 1979
Programming Principles and Concepts, Fall 2002
Advanced Basic for Programmers, Spring 2002
Database Programming and Procedures, Spring 2005
Advanced Database Programming, Spring 2006

University of Massachusetts, Amherst
Principles of Management, Fall 1981
Microeconomics, Fall 1980
Macroeconomics, Spring 1981
Social Conflicts and Natural Resources, Spring 1991
Biological Limnology, Fall 1991
Anadromous Fish, Fall 1991
Biostatistics, Fall 1991
Intermediate Biostatistics, Spring 1992
GIS, Spring 1992
Population Dynamics, Fall 1992
Animal Movement and Migration, Fall 1992
Coastal Zone Management, Spring 1993
Ichthyology, Fall 1993
Principles of Fisheries Stock Assessment, Spring 1994
Aquatic Invertebrates, Fall 1994
Freshwater Fisheries Management, 1997
Inland Fisheries Management, Spring 1999
Imaging in Fisheries Science, Fall 2000
Natural Resource Modeling, Spring 2001

American Fisheries Society Workshops
Fish Ageing, 1995
Stream Habitat Assessment, 1996

USFWS - National Education and Training Center
Principles and Techniques of Electrofishing, 1996

DOI-USGS – Motorboat Operator Certification Course, 2000

Certified S.O. Conte Anadromous Research Center dive team member

S.O. Conte Fish Research Projects:

Atlantic salmon behavior and movements in the Westfield River, Massachusetts 1996 to 1998 – wild adult Atlantic salmon returning to the Westfield River were internally radio tagged and released into the upper Westfield River. Fish were tracked with fixed stations and with manual tracking. Movement, habitat choice, spawning, and post-spawning behavior were evaluated. Domestic broodstock Atlantic salmon were also radio tagged and released to assess their spawning potential to contribute to the salmon restoration effort in the Connecticut River basin.

Spiral fishway 2001 to 2007 – evaluation of a spiral, side baffle fishway designed for upstream sturgeon fish passage. Sturgeon, a benthic fish, need a fishway that allows upstream movement while maintaining close proximity to the bottom of the fishway. The spiral uses side baffles to reduce velocity and provide depth allowing fish to move in a sinusoidal curve along the bottom of the channel. Sturgeon movement was evaluated with a PIT tag system detecting fish at the entrance and exit of the fishway and at four points along each of two loops. Riverine fish were also evaluated in the spiral fishway.

Shortnose sturgeon spawning behavior 2002 to 2008 – the spawning behavior of wild Connecticut River shortnose sturgeon was evaluated in an artificial stream. Mating behavior, mate choice, velocity preference, egg to larvae survival, and embryo and larval dispersal timing were evaluated.

Downstream passage and behavior studies of shortnose sturgeon 2004 and 2005 – yearling, juvenile and adult shortnose sturgeon were evaluated for swimming depth, behavior at and movement along a bar rack, entrainment and impingement, and willingness to enter an opening in the bar rack at three different approach velocities. Pressure sensitive (depth) and radio tags were used to assess swimming depth for both upstream and downstream movement in a 20’ by 120’ flume with a velocity of 1 ft/sec. PIT tags and video were used to assess individual fish movement and behavior at a bar rack oriented 90º to flow at velocities of 1, 2 and 3 ft/sec.

Downstream movement of yearling shortnose sturgeon 2004 and 2006 – yearling shortnose sturgeon (Connecticut River stock in 2004 and Savannah River stock in 2006) were evaluated in a large outdoor oval channel with a river stone substrate to determine the timing, frequency and duration of upstream and downstream movements. Fish were tested for 48 hours on a monthly basis from June through November. PIT tags and five antennas were used to determine movement.

Low level orifice use of sturgeon at an angled bar rack and louver 2006 to 2008 – green, lake, Savannah and Connecticut River shortnose sturgeon of different year classes were tested in a 10’ by 120’ flume at two bar rack angles (45º and 30º) and one louver angle (26º) with two velocities at the orifice. Approach velocity (2 ft/sec) and water depth (7.5’) remained constant for all trials. Fish were tested both day and night. Video and PIT tags were used to determine individual fish movement, behavior at the bar rack and passage through the orifice and pipe which transported fish downstream to a holding area.

Past Relicensing Projects:

Bear Swamp Hydroelectric Project – FERC # 2669
Relicensing of project through the ILP.
Deerfield River Project – FERC # 2323, License issued 1997
Deerfield River Compact – precursor to relicensing, all stakeholders in relicensing, including New England Power Co., met on a regular basis to discuss issues. Final report issued.
Deerfield River Settlement – followed the conclusion of the Deerfield River Compact with similar discussions as to the issues involved in relicensing with the goal of reaching agreement on environmental mitigation prior to issuing or license. Represented Trout Unlimited in

meetings with state and federal agencies, New England Power Co. and other NGO's which reached an agreement that was incorporated into and was the basis of relicensing by the FERC.

Holyoke – FERC # 2004, Connecticut River

Relicensing of project – bypass minimum flows, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, clupeids, and riverine fish), upstream passage (adult Atlantic salmon, clupeids, American eels, and riverine fish) freshwater mussel protection, flow priorities (bypass reach, canal, up- and downstream fish passage, hydrogenation, run of river protection of federally threatened tiger beetle), and disabled angler fishing access.

Comments to both company and the FERC concerning above listed issues.

Participant in CCT meetings representing Trout Unlimited concerning above listed issues. CCT consists of Holyoke Gas & Electric (project owners), state and federal agencies, and NGO's (Trout Unlimited and Connecticut River Watershed Council).

Indian River – FERC # 12462, Westfield River

Licensing of project – bypass minimum flows, freshwater mussel protection, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, riverine fish), upstream passage for American eels.

Participation in ongoing fish passage discussions regarding both up- and downstream passage issues.

L.S. Starrett Co. – FERC # UL09-01, Millers River

Installation of new turbine initiated local Conservation Commission and Massachusetts Department of Environmental Protection actions presently on hold due to a FERC order of jurisdiction dated October 21, 2009.

Intervened in Massachusetts Department of Environmental Protection appeal by Starrett of a Superseding Order of Conditions.

Commented to the FERC concerning Starrett Motion for Stay of Order of Jurisdiction regarding downstream fish passage.

Muddy Run Pumped Storage Project – FERC # 2355, Susquehanna River. Contracted by Maryland Power Plant Project to provide biological and fish passage assistance during relicensing and post licensing. Principle issues are entrainment and the impact of the project on river flows.

New Home Dam Project – FERC # 6096, Millers River

Post licensing flow issues - run of river requirement.

Northfield Mountain Pumped Storage Project – FERC # 2485, Connecticut River

License amendment allowing more storage in upper pond. River bank erosion concerns. Amendment application withdrawn.

Woronoco – FERC # 2631, Westfield River

Relicensing of project and 401 certification – bypass minimum flows, freshwater mussel protection, downstream fish passage (salmon smolts, adult Atlantic salmon, American eels, riverine fish), upstream passage for American eels, and recreation issues.

Analyzed telemetry data from downstream smolt test to provide independent review of results.

York Haven – FERC # 1888, Susquehanna River

Contracted by Maryland Power Plant Project to provide biological and fish passage assistance during relicensing. Relicensing is currently involved in settlement discussions with project owner, Olympus Power. Principle issues are up- and downstream fish passage for American shad and American eel and bypass flows.

Publications:

Kynard, B., D. Pugh, and T. Parker. 2003. Development of a fish ladder to pass lake sturgeon. Great Lakes Foundation, Final Report, Lansing Michigan.

Kynard, B., M. Horgan, D. Pugh, E. Henyey and T. Parker. 2008. Using juvenile sturgeon as a substitute for adults: a new way to develop fish passage for large fish. American Fisheries Society Symposium 61: 1-21.

Kynard, B., M. Kieffer, E. Parker, D. Pugh and T. Parker. 2012. Lifetime movements by Connecticut River sturgeon. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker, M. Kieffer. 2012. Spawning of shortnose sturgeon in an artificial stream: adult behavior and early life history. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker. 2012. Passage and behavior of Connecticut River shortnose sturgeon in a prototype spiral fish ladder with a note on passage of other fish species. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2012. Downstream and Diel Movements of Cultured Yearling Pallid, Green, Lake, and Shortnose Sturgeons: An Artificial Stream Study. In Life history and behavior of Connecticut Rver shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kynard, B., D. Pugh, and T. Parker. 2004. Experimental Studies to Develop Guidance and a Bypass for Shortnose Sturgeon at Holyoke Dam. Final Report to City of Holyoke, Holyoke Gas & Electric Company, Holyoke, Massachusetts.

Kynard, B., D. Pugh, and T. Parker. 2005. Experimental Studies to Develop Guidance and a Bypass for Shortnose Sturgeon at Holyoke Dam. Final Report to City of Holyoke, Holyoke Gas & Electric Company, Holyoke, Massachusetts.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2007. Use of laboratory studies to develop a dispersal model for Missouri River pallid sturgeon early life intervals. J. Appl. Ichthyol. 23: 365–374.

Kynard, B., D. Pugh, and T. Parker. 2011. Passage and behavior of cultured lake sturgeon in a prototype side-baffle ladder: I. ladder hydraulics and fish ascent. J. Appl. Ichthyol. 47 (Suppl. 1): 1-12.

Pugh, D., B. Kynard. 2001. Westfield River adult salmon report Westfield River, Massachusetts, 1966 – 1968. Final report to United States Forest Service and United States Fish and Wildlife Service.

Pugh, D. 1997. Millers and Chicopee River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 1998. French and Westfield River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 1999. Blackstone, Quinebaug, and Quabog River Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D and A. Haro. 2000. Passage of Atlantic salmon at Turners Falls fishways: PIT tag evaluation 1999. Conte Anadromous Fish Research Center Internal Report No 00-02.

Pugh, D. 2000. Merrimack, Ipswich, Charles, and Neponsett/Weymouth/Weir Basins Mussel Survey. Report to Massachusetts Natural Heritage and Endangered Species Program.

Pugh, D. 2001. 2001 Fort River dwarf wedge mussel (*Alasmidonta heterodon*) survey. Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program.

Pugh, D. 2002. 2002 Fort River dwarf wedge mussel (*Alasmidonta heterodon*) survey. Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program.

Presentations:

Movement and Habitat of Atlantic Salmon in the Westfield River. D. Pugh. Connecticut River Atlantic Salmon Commission Conference, 1999.

Zebra Mussels: Can We Stop The Eastward Invasion? M. Babione and D. Pugh. Northeast Fish and Wildlife Conference, 2003.

Passage of Sturgeons and Riverine Fishes in a Prototype Spiral Fish Ladder. B. Kynard, D. Pugh, T. Parker. American Fisheries Society Meeting, 2006

Behavior of Lake, Pallid, and Shovelnose Sturgeons at Passage Structures: Toward a New Paradigm in Developing Fish Passage. B. Kynard, M. Horgan, D. Pugh, E. Henyey, and T. Parker. American Fisheries Society Meeting, 2006.

Performance of Lake Sturgeons and Riverine Fishes in a Spiral Side-Baffle Fish Ladder. B. Kynard, D. Pugh, T. Parker. Connecticut River Atlantic Salmon Commission Conference, 2009.

Review of Using a Semi-natural Stream to Produce Young Sturgeons for Conservation Stocking. B. Kynard, D. Pugh, T. Parker, M. Kieffer. International Sturgeon Society Conference, 2009.

Up- and Downstream Passage and Behavior of Lake and other Sturgeons. D. Pugh B. Kynard and T. Parker. Keeyask Fish Passage Workshop, 2011.

Eel Passage Westfield & Millers Rivers, Massachusetts. D. Pugh. ASMFC Eel Passage Workshop, 2011.

Passage and Behavior of Cultured Lake Sturgeon in a Side-Baffled Fish Ladder: II. Fish Ascent and Descent Behavior. NAC. 2011.

Behavior, impingement, and entrainment of shortnose sturgeon at a vertical bar rack: with and without a bypass orifice. B. Kynard and D. Pugh. Fish Passage Conference, Amherst, MA. 2012.

Research on Up-and Downstream Passage of Lake Sturgeons at S. O. Conte Anadromous Fish Research Center. B. Kynard, D. Pugh, E Henyey, T. Parker and M. Horgan. *Scaphirhynchus* Conference: Alabama, Pallid, and Shovelnose Sturgeon Symposium, St. Louis, Missouri, January 2005

Shortnose Sturgeon Life History Requirements and the Holyoke Dam. B. Kynard, M. Kieffer, D. Pugh. Connecticut River Atlantic Salmon Commission Conference, March 2013

STATE OF MAINE
DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

JANET T. MILLS
GOVERNOR

PATRICK C. KELIHER
COMMISSIONER

July 17, 2021

Kathy Davis Howatt
Hydropower Coordinator, Bureau of Land Resources
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333

RE: Comments on Brookfield White Pine Hydro, LLC's Shawmut (FERC No. 2322) Hydroelectric Project

Dear Ms. Howatt:

The Maine Department of Marine Resources (MDMR) has reviewed the Brookfield White Pine Hydro, LLC's (BWPH; Licensee) Application for Water Quality Certification (U.S. P.L. 92-500, Section 401) for the relicensing of the Shawmut Project by the Federal Energy Regulatory Commission (FERC). MDMR has also reviewed the Draft Environmental Assessment (DEA), Interim Species Protection Plan (ISPP) for Shawmut, the Final License Application (FLA), Species Protection Plan (SPP) for Lockwood, Hydro-Kennebec, and Weston, as well as other relevant documents in our administrative record. MDMR provides the attached comments and Kennebec River factual background paper focused primarily on the proposal's impacts to diadromous indigenous aquatic fish species and their habitat.

Please contact Gail Wippelhauser at gail.wippelhauser@maine.gov or at 207-904-7962 if you have any questions.

Sincerely,

Patrick C. Keliher, Commissioner

Summary

Restoration of Atlantic Salmon, American Shad, Blueback Herring, Alewife, and Sea Lamprey has lagged on the mainstem Kennebec River, primarily because of the lack of upstream fish passage. This situation is particular critical for the endangered Gulf of Maine (GOM) Distinct Population Segment (DPS) of Atlantic Salmon, one of the most iconic and imperiled species in the United States. Diadromous fish species require safe, timely, and effective access to high quality habitats at different life stages in order to successfully survive and reproduce. The Shawmut Project waters currently are used as spawning and rearing habitat and/or a migratory corridor for five indigenous fish species (Atlantic Salmon, American Shad, Blueback Herring, Alewife, and American Eel). Upstream fish passage has been provided for juvenile American Eel at the lower four mainstem dams, but adult Atlantic Salmon, American Shad, Blueback Herring, and Alewife have been captured at the Lockwood Project fish lift and transported upstream for 15 years (2006-2021). A sixth indigenous species, Sea Lamprey, also will use the Shawmut Project waters as spawning/rearing habitat and as a migration corridor when new upstream passage is implemented at the Lockwood, Hydro-Kennebec, Shawmut, and Weston projects. These aquatic habitats are extremely important for diadromous fish and have been designated as Critical Habitat for Atlantic salmon under the Endangered Species Act (ESA) and Essential Fish Habitat (EFH) under the Magnuson Stevens Act (MSA) for a number of species based on the location and characteristics of habitats required to support healthy fish populations. Almost 100% of high quality Atlantic Salmon spawning and rearing habitat, over 50% of spawning and rearing habitat for American Shad and Blueback Herring, and significant areas for the other native anadromous species in the Kennebec river watershed is upstream of the Shawmut project.

The proposal as described in the Brookfield White Pine Hydro, LLC's (BWPH; Licensee) Application for Water Quality Certification (U.S. P.L. 92-500, Section 401), if implemented, will continue to have significant adverse impacts on these indigenous fish species and their habitat. These adverse impacts include, but are not limited to, anticipated low passage efficiency rates at upstream and downstream fishways, mortality and injury to upstream and downstream migrating diadromous fish, impaired in-stream habitat, significant delays in passage, and cumulative effects of multiple proposed fish passages at other projects in the watershed. Population modeling of the cumulative impacts of upstream and downstream passage of Atlantic Salmon, American Shad, Blueback Herring, and Alewife has shown that efficient downstream and upstream fish passage with minimal delays are critical to support these fish species' life history needs. Unless fish passage facilities meet MDMR's proposed performance standards based on this modeling and also provide effective passage for eels, the project waters will likely be of insufficient quality to support self-sustaining runs of these important indigenous species. Of particular concern, MDMR's analysis strongly indicates that the Licensee's proposal would preclude the ability to recover Endangered Species Act (ESA) listed Atlantic salmon in the entire Distinct Population Segment (DPS). In addition, studies have shown that similar fishways at wide, complex sites such as Shawmut could entirely preclude fish such as American Shad from passing upstream. The Department's goal is to restore diadromous fish populations in Maine to their historic habitat. To achieve this goal, MDMR has developed "minimum goals" that are achievable if suitable habitat of sufficient quality is available to support fish and other aquatic life. In other words, building fish runs to meet these minimum demographic goals is a

benchmark for having resilient self-sustaining populations, which require safe, timely, and effective passage and supportive aquatic habitats. The minimum goals and concerns about how the proposed project will not likely achieve those goals and discussion of additional impacts to fish and aquatic habitat are outlined below. More detail on the modeling and background can be found in the Kennebec River factual background provided as a separate document.

Minimum Species Goals for the Kennebec River

The minimum goal for **Atlantic Salmon** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 500 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for Endangered Species Act (ESA) down-listing and a minimum annual return of 2,000 naturally-reared adults to historic spawning/rearing habitat in the Kennebec River for reclassification based on the NOAA and USFWS Recovery Plan (2019). To reach spawning/rearing habitat in the Sandy River, Carrabassett River, and mainstem Kennebec River, all returning adults must annually pass upstream at the Lockwood, Hydro Kennebec, Shawmut, and Weston project dams.

The minimum goal for **American Shad** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 1,018,000[1] wild adults to the mouth of the Kennebec River; a minimum annual return of 509,000 adults above Augusta; a minimum of 303,500 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 260,500 adults annually passing upstream at the Shawmut Project dam; and a minimum of 156,600 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Blueback Herring** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 6,000,000[2] wild adults to the mouth of the Kennebec River; a minimum annual return of 3,000,000 adults above Augusta; a minimum of 1,788,000 adults annually passing upstream at the Lockwood and Hydro Kennebec Project dams; a minimum of 1,535,000 adults annually passing upstream at the Shawmut Project dam; and a minimum of 922,400 adults passing upstream at the Weston Project dam.

The minimum goal for **Alewife** is to provide safe, timely, and effective upstream and downstream passage in order to achieve a minimum annual return of 5,785,000[3] adults above Augusta; a minimum of 608,200 adults annually passing at the Lockwood, Hydro Kennebec, and Shawmut project dams; and a minimum of 473,500 adults annually passing upstream at the Weston Project dam.

The minimum goal for **Sea Lamprey and American Eel** is to provide safe, timely, and effective upstream and downstream passage throughout the historically accessible habitat of these two species.

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[1] Based on 5,015 hectares of spawning/rearing habitat and a minimum return of 203 adults per hectare.
[2] Based on 5,015 hectares of spawning/rearing habitat and a minimum return of 1,196 adults/hectare.
[3] Based on 9,946 hectares of spawning/rearing habitat and a minimum of 581.5 adults/hectare; the Maine State average is 988.4/hectare.

Performance standards necessary to meet minimum goals

Upstream fish passage
Based on the minimum goals, a project's facilities would be considered to be performing in a safe, timely, and effective manner if:

1. At least 99% of the adult Atlantic Salmon that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 48 hours.
2. At least 70% of the adult American Shad that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours.
3. At least 90% of the adult Blueback Herring that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours.
4. At least 90% of the adult Alewife that that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 72 hours; and
5. At least 80% of the adult Sea Lamprey that pass upstream at the next downstream dam (or approach within 200 m of the project powerhouse) pass upstream at the project within 48 hours.

Downstream fish passage
Based on the minimum goals, a project's facilities would be considered to be performing in a safe, timely, and effective manner if:

1. At least 99% of the Atlantic Salmon smolts and kelts that pass downstream at the next upstream hydropower dam (or approach within 200 m of the project spillway) pass the project within 24 hours.
2. At least 95% of the adult and juvenile American Shad that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.
3. At least 95% of the adult and juvenile Blueback Herring that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.
4. At least 95% of the adult and juvenile Alewife that pass downstream at the next upstream hydropower dam (or within 200 m of the project spillway) pass the project within 24 hours.

The Licensees Proposals for fish passage performance

It is unclear what the Licensee is proposing regarding salmon effectiveness standards for the Shawmut project as the proposed Interim Species Protection Plan (ISPP) does not include updated performance standards. In the SPP for the Lockwood, Hydro-Kennebec, and Weston project, the Licensee indicates they will need to achieve a whole station survival of 88.5% for downstream passage and 84.5% for upstream passage at the four projects for Atlantic salmon. This would indicate an average of 97% for downstream passage per project, and 96% for upstream passage. A cumulative performance standard is not supported by MDMR or consistent with the precedent set by the National Marine Fisheries Service (NMFS) and the Federal Energy Regulatory Commission (FERC) for the Milford (FERC No. 2534), West Enfield (FERC No. 2600), Mattaceunk (FERC No. 2520), Orono (FERC No. 2710) and Stillwater (FERC No. 2712) projects on the Penobscot River. Cumulative performance standards can allow one or more projects to perform poorly, increasing the possibility that the cumulative effects will be even greater and reducing project by project accountability. The Licensee does not utilize DMR's recommended performance standards or provide any of their own performance standards for American Shad, Blueback Herring, Alewife, or Sea Lamprey. MDMR has completed model scenarios that represent the best available science and finds that only with a 99% upstream and downstream passage efficiency at each project (Lockwood, Hydro-Kennebec, Shawmut, and Weston) can interim minimum goals be achieved for Atlantic salmon (Factual Background, 3.1.6). Based on MDMR modeling, the 99% upstream and 99% downstream effectiveness scenario resulted in 28-29% more adult salmon returns than the 96% upstream and 97% downstream scenario suggested in the SPP. Further, based the site conditions, initial testing, and experience with similar passage approaches implemented in other river systems, we find it highly unlikely that the Licensee will meet even their own proposed standards. The Licensee had previously indicated it could achieve lower standards yet has revised those standards upward without proposing any significant commensurate measures that would likely result in those improvements. With salmon runs below replacement levels currently, MDMR concludes that the adverse impacts of the current proposal will not provide conditions where a minimum sustainable population of Atlantic salmon can be supported in the receiving water. It is also possible that species such as American Shad, which have chronic poor performance at fishways, or Sea Lamprey, which are not considered by the Licensee and migrate primarily at night, could be entirely precluded from receiving waters based on cumulative impacts from downstream projects and likely ineffective passage at the Shawmut Project. The high numbers of dams in the lower Kennebec, unknown outcomes of fish passage at those projects, and poor demonstrated performance at similar fishways (Factual Background, Table 9) significantly increases the probabilities of failure to meet basic biological requirements for some or all of the indigenous species at the Shawmut project.

Issues with Proposed upstream fish passage facilities

The Licensee has proposed to construct permanent upstream fish passage (a single fish lift) at the Shawmut project. Successful fishways must create hydraulic signals strong enough to attract fish to one or multiple entrances in the presence of competing flows (i.e., false attraction). The Shawmut dam is extremely long and has multiple discharge locations that will provide significant false attraction flows during the passage season. MDMR has serious concerns about the design, operation, and location of the fishway and believes the current proposal will result in significant delays and likely poor upstream passage efficiency for multiple species. MDMR also has serious concerns about the cumulative adverse impacts of the Lockwood, Hydro-Kennebec, and Weston projects, which has similar issues.

MDMR is very concerned about the effectiveness of the proposed fishway in May, June, and July when the majority of anadromous species are migrating upstream (Table 1). The maximum station hydraulic capacity of the Shawmut Project is 6,690 cfs, which is exceeded approximately 65% of the time in May, 35% of the time in June, and 20% of the time in July. Water in excess of station capacity is spilled at the sluice gate in the middle of the 1,435-foot long dam, the hinged flashboards on the west side of the dam, or the rubber crest(s) on the eastern half of the dam, providing multiple false attractions. As a result, there will be false attraction at the project during the majority of the upstream migration season to multiple areas without a fishway to the headpond. A proposed cross channel egress from an identified false attraction zone would not provide passage to the headpond or directly to the lift.

Table 1. Upstream Run timing by month of Atlantic Salmon, river herring (Alewife and Blueback Herring) and American Shad captured at the Lockwood Project (2006-2020) and Sea Lamprey captured at the Milford Project (2009-2020).

Month	Atlantic Salmon	River herring	American Shad	Sea Lamprey
May	9%	72%	2%	56%
June	49%	28%	78%	44%
July	32%		19%	
August	2%			
September	3%			
October	4%			

The location of the fishway was based on very speculative assumptions using limited information. The CFD modeling that was conducted looked at a very limited range of flows that are not representative of the majority of the migration period. Furthermore, the siting study, conducted from May 19-June 14, 2016 with radio-tagged alewife, occurred during a low flow period, which is not representative of flows during the passage season. Alewives are not necessarily a good proxy for fish attraction of other species, as the Lockwood and Brunswick projects demonstrate. The existing American Eel fishway locations were selected based on flow conditions that will be changing based on the proposal.

While it is hard to predict the exact passage efficiency and delays rates at each project, the results of studies conducted on Atlantic Salmon and shad migrating upstream at the Lockwood Project are illustrative. The Lockwood and Shawmut projects are similar in that they are complex, wide sites, that have multiple sources of spill that create false attraction for migrating fish.

> Two years of telemetry studies by Brookfield were conducted at the Lockwood Project. In 2016, 16 of the 18 test fish (88.9%) which returned to the Project area were recaptured in the fish lift, and the time from return to the project area to recapture was 0.7-111.2 days (mean=17 days). In 2017, 14 of the 20 test fish (70%) were recaptured in the fish lift, and the time from return to the project area to recapture was 3.3-123 days (mean=43.5). As part of a study of energy consumption, adult Atlantic salmon were captured at the Lockwood fish lift, tagged with thermal radio tags and released downstream of the Project. In 2018, 66.7% of the tagged adults (4 of 6) were recaptured at the fish lift, and the time to recapture was 16-33 days (mean=21.8). The following year, 45.0% of tagged adults (9 of 20) were

recaptured, and the time to recapture was 9-30 days (mean=18.7). A 2015 study found that 0% of American shad captured in the fishway and returned downstream were recaptured at the fishway.

The Lockwood fishway (fish lift) was designed consistent with current standards for upstream passage of anadromous fish and yet the complicated setup at the dam has undermined the ability of the fishway to effectively pass fish. It would not be unexpected to have similar results at the Shawmut project. Results at projects such as Lockwood show significantly less than minimum goals necessary to support salmon populations and could fully preclude American shad or other species from accessing necessary habitats above the Shawmut project. MDMR believes having only one fishway at this site to the headpond that is non-volitional will likely result in large percentages of fish not finding the fishway and/or experiencing substantial delays.

Operational period

The Licensee proposed to operate the upstream fishway (fish lift) May 1 to October 31 during daylight hours. This proposed upstream operational period is inadequate to effectively pass all species upstream. Atlantic salmon have been documented in the Kennebec River migrating upstream for a longer season and sea lamprey predominately migrate during the night. Fish passage should be provided from May 1 through November 10 with operations occurring 24 hours per day from May 1 through June 30 to accommodate diurnal and nocturnal migrants. In addition, the proposed fish lift is not a volitional facility and its operation is vulnerable to regular mechanical failures and power outages. Fish lifts generally also have a minimum cycle time of about 15 minutes, during which time the fishway is closed. The Licensee considered at a conceptual level both a nature-like fishway (which is volitional) and a fish lift during a feasibility study, but only pursued the fish lift design. MDMR has further explored concepts developed in the Licensees feasibility study and has conceptual designs for a nature like fishway at this site, which can be made available to DEP upon request. There is potential with a nature like volitional and the similarly designed fish lift working together in separate locations, improved upstream fish passage efficiency and timeliness could be achieved.

Issues with Proposed downstream fish passage facilities

The Licensee proposes to utilize three gates in the forebay area (Sluice Gate, Tainter Gate, and Deep Gate) and up to four sections of hinged flashboards to pass fish downstream. The licensee also proposes a guidance boom (discussed below) and no screening protection of fish through the Francis Turbines. Unlike the Licensee proposal in the SPP for the Lockwood, Hydro-Kennebec, and Weston projects, the Licensee does not propose any specific low flow thresholds that would require curtailment of generation to provide for additional spill for protection of downstream passage of Atlantic salmon smolts. The proposal also fails to provide adequate protection for other species during their period of downstream passage. The proposed downstream operational facilities are inadequate to safely and effectively pass Atlantic salmon and all species downstream.

Radio telemetry studies conducted at the Weston, Shawmut, Hydro-Kennebec, and Lockwood projects resulted in baseline survival of downstream migrating Atlantic salmon smolts ranging from 89.5–100%, but only 66-94.5% of smolts successfully passed the projects within 24 hours. The Shawmut project averaged 93% survival. This analysis only measured survival from just above to just below the projects and fails to take into account the impact of the latent mortality and other mortality associated with the cumulative effects of passing multiple projects. For example, smolts that were released at Weston and detected at Lockwood had much lower survival, with a four-year average of 56%, and that does not include the impacts of the Weston impoundment as fish were released just upstream of the dam.

To assess the true impacts of the projects, it is important to account for survival with dam dependency. The NOAA Science Center modeled smolt survival with dam dependency (Stevens et al. 2019) using 40 years of data on the Penobscot River, with estimates of estuarine mortality for fish that passed 4 dams at 1.15% per kilometer versus 0.34% with no downstream dams (natural mortality baseline). MDMR developed a deterministic salmon model utilizing this data and other data in the watershed and modeled smolt survival with four dams under a number of scenarios. Using the passage scenario of 96% upstream and downstream passage per project, these projects would result in a 45% reduction in smolt survival to sea compared to smolt survival without the projects. Using the updated 97% survival per project proposed in the SPP (12% direct mortality across four projects) and NOAAs estimate from a dam impact model (Neiland and Sheehan 2020) of 6% mortality per dam baseline (24% indirect mortality across four projects), would result in 36% mortality of smolts from project effects alone. In NOAAs August 28, 2020 preliminary Section 18 prescription, their analysis estimated about 40% loss of smolts due to project impacts. The loss of between 36-45% of smolts from dam impacts in addition to baseline mortality on a salmon run that is currently below replacement is not supportive of recovery, even under the most favorable marine survival and freshwater production scenarios. It is unlikely that the Licensee could even achieve the 97% downstream standard based on their proposal as many fish would still be entrained in turbines without shutdowns or full screening. Thus, representations of "Whole Station Survival" vastly understate the current take of these projects as they measure only a small window of impacts that do not account for large impacts of impoundments and latent impacts to fish that pass dams (e.g. delayed mortality in estuary rather than directly after passing project). In addition, in their Augusta 28, 2020 preliminary prescription for the Shawmut project, NOAA predicted that the overall survival of kelts through the four projects cumulatively would be 42% to 51%, an incredibly low number of fish that would preclude the important life history trait of repeat spawning.

The proposed guidance structures (discussed below) at the project are unlikely to prevent or reduce entrainment of smaller alosines. In addition, smaller alosines are more likely to migrate past the Lower Kennebec Projects during the summer months (July-September) when water levels are not likely to result in spill at the project. Due to the reduced swimming ability of smaller alosines and the timing of their migrations, MDMR believes that smaller alosines are likely passing through the turbines of the projects at a high rate. Juvenile alosines migrate downstream from freshwater nursery habitat in Maine between July and November each year. While some juveniles stay in nursery habitat and reach lengths of 100-150mm before their downstream migration, a significant portion of the downstream migrants are much smaller (total length 40-100mm) and typically migrate earlier in the year. Smaller alosines do not have the same swimming ability as larger fish and are more likely to utilize routes of passage in a manner proportionate to the ratio of flow to a given a route. For this reason, smaller juvenile alosines are likely to be entrained as they migrate past the project and turbine passage has been documented as the route of highest mortality (acute and latent) when compared to other passage routes. This will result in adverse impacts to these species and not be conducive to meeting demographic or other goals to maintain self sustaining runs above these projects.

Surface Guidance Boom

The Licensee proposed to construct a fish guidance boom system that is intended to preclude downstream migrating fish from entrainment in Units 7 and 8. MDMR does not support the Licensee's proposal to use surface guidance booms at the Shawmut Project and finds them to be inadequate to protect the GOM DPS population of Atlantic Salmon and the other diadromous species in the Kennebec River. Data provided by the Licensee in the (SPP, Table 5-1) demonstrates that the guidance booms used at the Lockwood, Hydro-Kennebec, and Weston Projects do not guide 14.3-30.6% of the migrating smolts away from the turbines. Data provided by the Licensee (FLA, Table 4-22) shows that 32.7% of the downstream migrating smolts were entrained into the turbines at the Shawmut Project. The instantaneous survival was 7% lower when fish went through the turbines compared to spill routes at Shawmut and that grossly underestimates the sublethal effects, including injury and disorientation, that would result in higher mortality in the estuary. Studies at the Ellsworth dam on the Union river assessing injury to salmon showed that 22-30% of fish that went through the turbines had injuries compared to 3.8% that went through spill routes, demonstrating that impact quantitatively. The 2015 *Evaluation of Downstream Passage for Adult and Juvenile River Herring* demonstrated that 53 percent of the study fish went through the Lockwood turbines, rather than being guided by the boom to the downstream bypass, and survival was lowest for those fish passing Lockwood via the units (i.e., 77-4-81.7% survival).[4] This would indicate that performance standards would not likely be met for these species with the proposed plan.

In addition, MDMR has consulted with the USFWS regarding floating guidance booms and concurs with their comments that are provided below.

> "The Service does not know of any studies that have assessed how effective floating guidance booms are at protecting eels as they attempt to migrate downstream past a hydroelectric project. However, we do know that eels are a bottom-oriented species (Brown et al. 2009) and therefore a floating guidance boom with partial depth panels would not be fully protective. As stated in our 2019 Fish Passage Engineering Design Criteria manual, "A floating guidance system for downstream fish passage is constructed as a series of partial depth panels or screens anchored across a river channel, reservoir, or power canal. These structures are designed for pelagic fish which commonly approach the guidance system near the upper levels of the water column. While full-depth guidance systems are strongly preferred, partial-depth guidance systems may be acceptable at some sites (e.g., for protection of salmonids, but not eels)." Booms have not been implemented as a protective measure for eels or alosines anywhere else in our region, which spans fourteen states, unless they are installed with other protective measures that are suitable to ensure the safe, timely, and effective downstream passage of our trust species (e.g., inclined bar screens, angled bar racks, etc.). Therefore, the Service recommends that any protective measure implemented at the mainstem Kennebec River hydroelectric projects, as part of the current SPP process, are

[4] Accession No. 20160331-5144

protective of all migratory species and that the proposed mitigation measures comport with the Service's fish passage guidelines."

Operational period

The Licensee proposed to operate the downstream fishway as follows:

- Continue to operate the existing forebay surface sluice gate at maximum capacity to pass up to 35 cfs from April 1 to December 31 to provide a continuous surface bypass route for downstream migrating fish.
- Continue to spill 600 cfs through the existing forebay Tainter gate from April 1 to June 15 to provide a passage route for Atlantic salmon smolts.
- Continue to provide a total of 6% of Station Unit Flow (about 400 cfs at maximum generation) through the combined discharge of the forebay Tainter and surface sluice gates from November 1 to December 31 to provide a safe passage route for Atlantic salmon kelts.
- During the interim period between license issuance and the installation of the new fish guidance boom, continue to lower four sections of hinged flashboards to pass 560 cfs via spill from April 1 to June 15 to provide a safe passage route for Atlantic salmon smolts.
- Continue to pass approximately 425 cfs through the forebay deep gate and shut down Units 7 and 8 for 8 hours during the night for 6 weeks between September 15 and November 15 for downstream adult eel passage.

This proposed downstream operational period is inadequate to safely and effectively pass all species downstream. Alewives and blueback herring leave the spawning grounds immediately after spawning and begin their downstream migration. American shad exhibit similar behavior. This downstream migration typically occurs between May and September each year. In addition, juvenile lifestages of these three species of alosines begin migrating downstream as early as July when they are only approximately 40mm long. Larger juveniles will migrate downstream as late as November depending on environmental variables freshwater nursery habitats. The Licensee has proposed to cease operation of the forebay Tainter gate after June 15th, which would leave only the forebay sluice gate in operation. The maximum capacity of the sluice gate is approximately 35cfs, which is 0.52% of station capacity and is 0.43-0.81% of average flow at the Shawmut dam between June and September.

The Licensee also mentions that they will prioritize units for protection of Atlantic salmon. Based on the average daily inflow reported in table 2 of the EA, station capacity will be exceeding in all months except July, August, and September. Therefore, station capacity will be exceeded at the project for the majority of the downstream migration of Atlantic salmon smolts and adult alosines in the spring and the majority of the juvenile alosines and adult eels in the summer and fall. While unit prioritization is proposed for these times as a protective measure, the prioritization will not be in effect as all units will be "on".

Turbine screening

The licensee did not propose any additional screening, however FERC has suggested screening may be required as this was suggested in NMFS Section 18 preliminary prescription. The preliminary screening suggestion is to equip each powerhouse with full-depth trash rack bars clear spaced at 1.5-inches and 3.5-inches for Units 1-6 and 7-8 respectively. This screening approach is inadequate for Atlantic salmon and does not take into account juvenile river herring, shad, sea-lamprey, or eels so will not result in safe downstream passage of indigenous species. In order to protect downstream migrating Atlantic Salmon smolts and kelts, adult and juvenile Alewife, adult and juvenile American Shad, adult and juvenile Blueback Herring, and adult American Eel, and adult and juvenile sea-lamprey, the Licensee would need to install full-depth inclined or angled screening with much smaller spacing and sized so that the normal velocities should not exceed 2 feet per second measured at an upstream location where velocities are not influenced by the local acceleration around the guidance structures.

Non-Attainment

MDMR notes that aquatic life monitoring in the Shawmut impoundment indicates a finding of non-attainment ME0103000306_339R_01. https://www.maine.gov/dep/water/monitoring/305b/2016/28-Feb-2018_2016-ME-IntegratedRptLIST.pdf.

Conclusion

The proposal by the Licensee will have significant adverse impacts to fisheries habitat and aquatic life and does not provide sufficient protections for indigenous species. Many additional items, such as full depth appropriate screening, a second volitional fishway near a major area of attraction flow on river right, and reliance on other best protective practices and available science should be considered further.

From: Christman, Paul <Paul.Christman@maine.gov>
Sent: Wednesday, July 28, 2021 1:17 PM
To: John Burrows <jburrows@asfmaine.org>
Cc: Wippelhauser, Gail <Gail.Wippelhauser@maine.gov>
Subject: Kennebec Habitat

John

I wanted to follow up with you regarding our conversation about Atlantic salmon habitat below the four mainstem dams on the Kennebec River between Skowhegan and Waterville.

As I mentioned to you, the mainstem of the Kennebec River downstream of Skowhegan isn't considered as having juvenile rearing habitat. Some portions of it may meet some of the physical characteristics of habitat during portions of the year however given the numerus issues like the predatory fish assemblage, lack of thermal refuge and poor water quality (Biological Valuation 2009 page 78) make this reach unlivable for vulnerable juveniles. This is why in the Biological Valuation 2009 on page 79 NOAA scientist stated "The Mainstem Kennebec has the highest biological value to the Merrymeeting Bay SHRU because it provides the central migration conduit for much of the currently occupied habitat found in the Sandy River". The high biological value for both rearing and spawning habitat is in the Sandy River above the mainstem. Essentially, it's the high biological value of the rearing and spawning habitat in the Sandy River that makes the mainstem corridor valuable. MDMR agrees with NOAA scientists regarding this conclusion.

Also, I wanted to comment on the physical habitat surveys that the Atlantic Salmon Commission conducted on the mainstem Kennebec River. This survey was conducted in anticipation of the construction of the Lockwood Fish Lift and the initiation of salmon restoration. The primary goal of the survey was to characterize the reach of river below Lockwood to head of tide for holding pool and potential sites for angling opportunities. The survey technique measured numerus physical characteristics such as depth, widths and substrate. While some of this information can be used to physically classify sections as juvenile rearing and spawning, these surveys do not take into account any qualitative information and were never intended for this purpose.

I also want to add that in the Kennebec River below the four dams there are some tributaries that are capable of rearing Atlantic salmon. Both Bond Brook and Togus Stream have been habitat surveyed and determined to have juvenile rearing habitat as well as spawning habitat. Bond Brook has 174 rearing units and 3.64 spawning units while Togus Stream has 384 rearing units and 3.24 spawning units. Unlike the mainstem Kennebec River adult salmon have spawned in both of these streams and MDMR had documented survival to the parr stage. Both streams do have habitat that can support salmon. Partial or complete surveys have been conducted on the Sebasticook, Cobbossee, Seven Mill and Messalonskee streams but we currently have no indications that they are capable of rearing juveniles. Most of these streams are very small and have under 200 hundred units except for the Sebasticook Stream which likely has several thousand units.

If you need more information, please let me know.
Paul

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